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WATER AND SANITATION FOR HEALTH PROJECT

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DEVELOPMENT OF AN OPERATION AND MAINTENANCE SYSTEM FOR SHABA REFUGEE WATER SUPPLY PROJECT

WASH FIELD REPORT NO. 170

JUNE 1986

Prepared for
the USAID Mission to the Republic of Zaire
WASH Activity No. 174

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by

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and
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LIST OF ACRONYMS

AIDR	Association International de Développement Rural (Belgian International Rural Development Association)
DEO	Design and Evaluation Office (of USAID Mission)
FBI	Fonds de Bien-être Indigéne (Local Improvement Fund)
GOZ	Government of Zaire
MPR	Mouvement Populaire de la Révolution (People's Movement for the Revolution)
PNA	Programme National d'Assainissement (National Sanitation Program)
REGIDESO	Régie de Distribution d'Eau de la République du Zaire (National Urban Water Agency)
SANRU	Projet de Soins de Santé Primaires en Milieu Rural (Basic Rural Health Project)
SNHR	Service National de l'Hydraulique Rural (National Rural Water Supply Agency)
SRHP	Shaba Refugee Health Project
UNHCR	United Nations High Commissioner for Refugees
VLOM	Village level operations and maintenance

EXECUTIVE SUMMARY

The Shaba Refugee Water Supply Project was designed in September 1984 by USAID/Zaire in collaboration with the Association Internationale de Développement Rural (AIDR), a Belgian private voluntary organization, and the National Rural Water Supply Agency (SNHR). The purpose of the project is to provide increased access to potable water in the Lualaba Sub-Region of Southwest Shaba through the provision of boreholes and renovated wells equipped with handpumps, spring catchment systems, and piped water distribution systems. During project design it was not possible to include a significant operation and maintenance (O&M) component. Instead, it was proposed to invite a WASH team during the early stages of project implementation to design an O&M system to serve the water supply project. At the request of the United States Agency for International Development (USAID) Mission Design and Evaluation Office (DEO) in Zaire, the Water and Sanitation for Health (WASH) Project sent a two-person team to Zaire from October 13 to November 15, 1985, to design an O&M system including a training needs assessment and institutional development component.

The following is a summary of the consultants' findings and recommendations:

FINDINGS

1. Handpumps were installed during the past 12 to 40 years by AIDR in the Lualaba Sub-Region. Almost all the handpumps at present are not functioning due to a lack of trained maintenance personnel and spare parts and a lack of feeling of responsibility for O&M on the part of the user communities. The fact that there have been two wars and associated periods of anarchy in the area may have contributed to this neglect.

2. The Zairian government's National Rural Water Supply Policy provides that the management, maintenance, and repair of rural water supply systems is solely the responsibility of the user community as represented by a village water committee. The users must also pay for all maintenance costs.

3. The demographic reality and existing hydrogeological situation will not permit following the project paper's initial proposal of installing two to three water points in each village.

4. The annual O&M costs for spring catchments are minimal; however, the annual O&M costs per household for handpumps are estimated to be 190Z and for piped water distribution systems between 61Z and 122Z. In view of these costs, villages with fewer than 250 inhabitants may not have the financial capacity to support the recurrent O&M costs of handpump maintenance.

5. The majority of villages surveyed expressed an interest in receiving an improved water supply system and a willingness to support the maintenance costs and provide O&M management for the water installations.

6. Local organizations exist at the community level; however, extension work and training will be necessary to strengthen the communities' capacities

and assist them in acquiring the skills they need to manage O&M and to collect and manage a village maintenance fund.

7. Several villages expressed a reluctance to organize a maintenance fund as they did not have sufficient trust in anyone in the village to act as treasurer. They did, however, have confidence in the church missions and would be willing to entrust their fund to a responsible person at a mission located near the village.

8. Many villagers also expressed a preference for water collected at a river or stream as opposed to water from a well. This is due to taste preferences and to the unhealthful conditions of existing open wells. Health education activities are to be carried out to develop an awareness of the benefits of using improved water installations as a potable water source. This will increase the probability of villagers using the improved water source in an appropriate fashion.

9. The field surveys have shown that technically-oriented individuals are available at the village level. If properly trained, these people could perform the role of caretakers and ensure the daily operation of the water system and carry out preventive maintenance tasks. Bicycle repairmen are the only qualified craftsmen that exist in sufficient numbers in the sub-region to ensure the routine repair of pumps or water distribution systems at a reasonable cost. However, they must receive the necessary training and have the necessary equipment. Back-up maintenance services for extraordinary repairs that surpass the capacity of the repairmen could be provided by mechanics at church-based garages (again if they were provided with specialized training and equipment) or by the SNHR station.

10. Shopkeepers showed relatively little interest in distributing spare parts for pumps. Apparently they believe that the low volume of parts involved would not be profitable. The rural population, most government representatives in the area, and representatives of non-governmental organizations agree that a self-sustaining spare part distribution would be best managed by the Catholic and/or Methodist churches. The representatives of both churches in the area have expressed their interest in and willingness to manage such a system if their respective bishops concur involvement and if the project can supply them with an initial stock of spare parts to serve as a revolving fund. Cooperation Belge has agreed, in principle, to provide services to the churches as procurement agent for spare parts. This would involve ordering parts in Kinshasa and arranging transport to and storage in Lubumbashi.

11. The original extension unit (two extension workers) planned for the project will be inadequate. The extension unit will need to make some 6,000 village extension and follow-up visits as well as to train 4,000 water committee members. Given the fast pace at which the project proposes to install water supply systems and the need for village-level O&M (VLOM), it will be necessary to upgrade and expand the project's extension/training unit.

12. The extension workers will have a limited time to carry out user and health education during the extension work and training activities, and they will not be able to return to the villages on a regular basis to

carry out these activities. Health personnel at local dispensaries in the area expressed an interest to do so; however, they lack health education skills, visual aids, and bicycles.

13. The field work has revealed that there is a lack of information and, in some cases, even false information about the project on the part of the local population, government services, and the churches.

14. The original project budget does not include any provisions for the procurement of spare parts for any water supply systems or tools for village caretakers and repairmen. Furthermore, the training and extension activities are not adequately funded.

RECOMMENDATIONS

1. It is recommended that a three-tier O&M system in the Lualaba Sub-Region be established based as much as possible on existing structures and services. The components of this system would include: village caretakers, local repairmen, and a back-up maintenance service.

2. It is recommended that the project develop criteria based on references presented in this report for the selection of villages which are to receive an improved water supply and develop allocation criteria as to the number and types of water installations proposed to a village. (8)(15)(16)

3. It is recommended that the beneficiary populations should have ownership of the water points. This means that they will be expected to participate in construction, installation, and maintenance and pay for all the recurrent maintenance costs of their water supplies.

4. It is recommended that AID, AIDR and SNHR jointly develop a protocol defining the exact contributions to be made by the beneficiaries for each type of planned water installation.

5. All decisions regarding the choice of water supply installation(s) and site selection should be taken with input jointly by the beneficiary population and the technical and extension teams taking into account technical and cultural factors as well as the community's financial capacity to pay for the maintenance costs of the water system in question.

6. The beneficiary populations should elect a water committee which will be responsible for the overall water supply system management. The village should also select a villager caretaker to carry out preventive maintenance tasks. These community members should be trained by the extension/training unit. Ideally these village level workers would have experience in community self-help projects as described in Section 3.2 of this report.

7. It is recommended that a written agreement be signed between the village water committee and SNHR which formalizes the users' ownership of the water supplies and their acceptance of all management and maintenance responsibilities. Moreover, the villagers must demonstrate proof of their commitment by establishing a maintenance fund and collecting an amount

equal to the first year's recurrent O&M costs. In addition, the committee should purchase the supplies and tools for the caretaker. These should be made pre-conditions before construction can begin.

8. As the beneficiary populations are expected to pay for the O&M of the water installations, it is recommended that SNHR take steps legally to prohibit all local authorities from levying additional taxes on water supply installations.

9. It is recommended that the beneficiary population and the technical and extension teams jointly select approximately 100 bicycle repairmen to be trained by the project's pump installation unit in collaboration with the extension/training unit. The repairmen will receive an initial training followed by a "hands-on" training during which they will assist in installing five pumps in neighboring villages. A similar selection and training process should be developed for water distribution system maintenance personnel. Tool kits purchased by the project should either be sold or provided on credit to all repairmen. All repairmen will be contracted and paid for by the communities for specific repair jobs when needed.

10. The project should identify three church-based garages with qualified mechanics to provide back-up repair services. It is recommended that specialized training and equipment be provided to these institutions for this purpose.

11. It is recommended that SNHR and AIDR enter into discussion with church representatives at the local and diocese levels and with Cooperation Belge to finalize the organizational and financial framework for a spare parts distribution system. An initial stock of spare parts sufficient for 18 months should be purchased with project funds and donated to the missions that will function as spare parts distribution outlets.

12. It is proposed to upgrade the extension/training unit of the project and to recruit a competent extension/training unit chief. He, in turn, should recruit four additional extension workers (for a total of six workers) with local language skills who will be hired and paid for by the project. The extension workers should be trained in community development/extension work techniques geared toward rural water supply. In addition they should possess the skills necessary to train village water committee members in maintenance, management, simple bookkeeping, and user and health education.

13. As the project does not have the personnel to implement a sustained program of health education in the villages, it is recommended that AID reach an agreement as to which of the AID-funded health projects (SANRU II or the Shaba Refugee Health Project) should provide the existing health personnel in the sub-region with bicycles and with health education training materials.

Chapter 1

INTRODUCTION

1.1 Purpose of the Mission

The Shaba Refugee Water Supply Project was designed in September 1984 by USAID/Zaire (DEO) in collaboration with the Association Internationale de Développement Rural (AIDR), a Belgian non-governmental organization and the Service National d'Hydraulique Rural (SNHR), the Government of Zaire department responsible for rural water supply. The purpose of the project is to provide increased access to potable water in the Lualaba Sub-region of Southwest Shaba, an area where there have been extensive demographic movements during the past eight years as a result of the 1977-78 rebel incursions and more recently the civil war in neighboring Angola. Because of time and personnel constraints it was impossible to include a significant operation and maintenance (O&M) component in the project design. Instead, it was proposed to invite a Water and Sanitation for Health (WASH) Project team during the early stages of project implementation to design an O&M system for the water supply project.

In September this proposal was formalized when the U.S. Agency for International Development (USAID)/Zaire requested through the Office of Health in the Bureau for Science and Technology (S&T/H) the assistance of a two-person team to carry out the following scope of work:

- Critically review with AIDR and SNHR the project plan and proposed maintenance program.
- Develop field survey instruments and protocols for assessing needs.
- Survey and assess the technical, socio-cultural, economic, human resources, and institutional factors impinging on the development of an O&M system that is socially sound, financially practical, effective, and technically feasible.
- Formulate a plan for such a system including a training and institutional development component.
- Follow up with further refinement of the training needs and training design.

After initial discussions with USAID/Zaire and the implementing agencies, AIDR and SNHR, it appeared that the extension services planned for the water supply project were inadequate to meet even the initial need to sensitize and organize the population prior to construction, let alone to provide management and sanitary education training to local user groups. As a result, the team's scope of work was expanded to include a needs assessment for the project's extension services.

Two WASH consultants, Lane Hoffman, a sociologist, and Peter Buijs, a civil engineer, visited Zaire from October 13 to November 15, 1985, to carry out this assignment under WASH Activity No. 174. They worked in close collaboration with Cit. Kabagema, a sociologist with AIDR.

1.2 Rural Water Supply in the Republic of Zaire

The Service National d'Hydraulique Rural (SNHR) is the Zairian government agency responsible for the construction of water supply systems in rural areas. Although SNHR was created just three years ago in 1983, its predecessor had been involved in rural water supply activities on a limited scale since 1977, mainly with UNICEF (the U.N. Children's Fund) assistance. SNHR's brigades, relying heavily on assistance from the beneficiary populations, engage in spring capping, well digging, installation of handpumps and other pumping systems, and the construction of gravity-flow distribution systems. Given the limited means SNHR had had at its disposal to date and the enormous size of the country, the agency's impact and coverage to date have been limited.

In 1984 and 1985 a National Rural Water Supply Policy and Strategy Statement was developed and the U.N. Water and Sanitation Decade goals were revised. Specifically, the main goal is to increase the rate of water supply coverage in rural areas so that approximately 50 percent of the rural population will have access to potable water sources located close to their homes by 1991. In addition, sanitation services are to be improved simultaneously, supported by a primary health care system and a sanitary education program. With regard to O&M, it has been decided that the rural water users will be entirely responsible for all aspects of management, maintenance, repair and, if possible, amortization of their systems.

Funding for rural water supply activities and SNHR institutional development has recently been increased through SANRU II, a USAID-funded primary health care project. Funds are made available for developing SNHR's planning, management, and training capacities and for spring capping, well digging and borehole drilling, installation of handpumps, and the construction of gravity-flow distribution systems.

Water supply activities are organized through a system of rural health zones organized by the Department of Public Health. Each zone is to have a trained rural water coordinator who will be in charge of extension, management, training, and back-up support for O&M. Whenever the technical complexity of a water supply system exceeds the competence of the rural water coordinator and the local population, an SNHR brigade will be requested to provide technical assistance. Given the vastness of the country it is proposed to increase the number of SNHR brigades from 10 to 26 under SANRU II.

In addition to SANRU II, the Shaba Refugee Water Supply Project and UNICEF, a number of non-governmental organizations also provide assistance for rural water supply activities.

1.3 The Shaba Refugee Water Supply Project

1.3.1 Goal, Purpose, and Beneficiaries

The goal of the Shaba Refugee Water Supply Project is to reintegrate the Lualaba Sub-Region into regional socio-economic development. As such it is a companion project to two other USAID-funded projects in the Lualaba Sub-Region, a health infrastructure development project and a road improvement project.

The purpose of the project is to improve the water supply systems in the sub-region, both in terms of quality and accessibility. The project will renovate 140 old wells, drill 430 new borehole wells, install 570 handpumps, cap 500 springs, and construct water distribution systems, based, where possible, on gravity flow and in some cases on renewable-energy-powered pumping systems. These improvements will directly benefit the major part of the population, and the entire population will benefit indirectly from improved water supply to common institutions such as hospitals, health centers, and schools.

Finally SNHR will benefit from the project through the training of six brigades, including its first borehole drilling brigade.

1.3.2 Project Implementation

The project is to be implemented by AIDR, a Belgian non-profit contractor with extensive experience in Africa, in collaboration with SNHR. The project grant agreement was signed by USAID and the government of Zaire (GOZ) on March 29, 1985, and on June 5, 1985, AIDR signed a cooperative agreement. Finally a memorandum of understanding was signed by the GOZ and AIDR on June 6, 1985. Officially the project has been launched, but so far progress has been slow.

AIDR fielded a team of two expatriates (project manager and construction specialist) in Lualaba in August 1985. They were followed by four SNHR employees in September and October. Project activities thus far have focused on the construction of housing for expatriate and senior staff and office buildings, on pre-feasibility studies for the seven water distribution systems, and on preparing detailed budgets for 1985 and 1986.

The project manager plans to cap 35 springs and rehabilitate 5 wells by March 31, 1986, but thus far no villages have been selected.

Project implementation has been hampered by the following setbacks:

1. Because of serious financial problems all AIDR accounts in Belgium have been blocked and, pending legal proceedings, AIDR will cease to exist. This means that equipment cannot be ordered from overseas. Also AIDR/Zaire employees' time is being spent trying to reorganize themselves as a separate agency and renegotiating all AIDR's contracts in Zaire. It is unlikely that these problems will be overcome before December 31, 1985, and in order not to slow down project implementation another procurement strategy for foreign commodities may be required.

2. On his arrival in Shaba, the appointed SNHR senior counterpart, the station chief, left government service to join a mining company.

3. While the project paper anticipated hiring six sociologists to provide extension services to the project (sensitizing and organizing the beneficiary population prior to construction, training, and follow-up) the final project description annexed to the grant and cooperative agreements only identified the need for two extension workers. Thus far only one of these has arrived and his initial effectiveness will be hampered by his lack of previous experience with water supply activities and the fact that he speaks none of the local languages of the area. Moreover, his proficiency in Swahili is not adequate to carry out local village extension work in rural water supply. Given the fast pace at which the project proposes to install water supply systems and the need for village level O&M (VLOM), it is felt that both the number of extension workers and their training needs should be reconsidered.

1.3.3 Operation and Maintenance

As stated above, no O&M component was designed for this project. It was proposed, however, to limit the technological complexity of the installations so local caretakers trained by the project could carry out basic maintenance. At the time of the consultancy, project personnel had not yet devised any maintenance plan, and there is no specific budget line item for O&M. There are, however, fairly significant budget allocations for training and extension for which virtually no expenditures have been planned. Procurement of spare parts or tools for local caretakers/repairmen had not been envisaged.

1.4 Other Donor Activities in the Lualaba Sub-Region

As mentioned above, the Shaba Refugee Water Supply Project is one of three complementary USAID-funded projects. The Shaba Refugee Health Project (SRHP) will focus on rebuilding and re-equipping a number of medical facilities in the sub-region that were damaged during events in 1977-78. Assistance will also be provided in the form of vehicles and renewable energy installations, and in some areas public health activities will be supported. This assistance,however, is limited to the Catholic, Methodist, and Garenganze medical facilities and dispensaries; state health facilities in the sub-region are excluded. Moreover, although the Shaba Refugee Health Project does provide support to some public health activities, this support is not extended on a consistent basis throughout the four rural health zones and therefore does not meet the primary health care needs of the sub-region. The project is to be implemented by the United Methodist Church in Zaire. No project implementation team has been fielded to date. To the extent that activities of this (SRHP) project can be utilized for the water supply project this should be encouraged. However, it should be recognized that this assistance may be marginal and should not be counted on as a requisite for project success. The same can be said for SANRU intervention.

The purpose of the Shaba Refugee Road Project is to improve year round accessibility in the sub-region to allow transport of supplies and agricultural produce. Lualaba is a potentially rich agricultural area. The project will be implemented by the Office of Roads and the Organization for Rehabilitation and Training (ORT) Foundation, but thus far project activities have not yet begun.

The U.N. High Commissioner for Refugees (UNHCR) is funding a 3-year settlement project for some 22,000 Angolan refugees who are concentrated in the Dilolo-Kisenge area. The project, which is implemented by EUMC (Entre-aide Universitaire Mondiale du Canada), has programs in agriculture, a community development, water supply, and infrastructure. Water supply efforts have focused thus far on spring capping and hand-dug wells, both with a mediocre success rate. It is planned to improve the wells by installing concrete rings and RCBF handpumps, which are designed and will be manufactured in Lubumbashi.

The Methodist, Catholic, Garenganze, and, to a lesser extent several other churches actively subsidize and support the social services in the area, in particular health and education. These services experienced considerable setbacks during the 1977-78 events and still have not yet reached the previous level of service. The Catholic Church also supports an agricultural cooperative and road maintenance efforts in the area.

To date SANRU I support in the sub-region has been limited to one rural health zone, namely Kapanga where the United Methodist Church operates a hospital, nursing school, and a rural dispensary system.

No commitments have as yet been made for assistance from SANRU II for the four rural health zones in the sub-region.

Chapter 2

METHODOLOGY AND APPROACH

The approach followed to carry out the assignment consisted initially of in-depth discussions with AID, AIDR, SNHR, and other organizations involved in the rural water supply sector to determine the past experience and present status of O&M activities for rural water supplies in Zaire and specifically in the Lualaba Sub-Region.

Discussions also took place in the sub-region with local government and administration officials, military officials, representatives of government services (health, social affairs, agriculture, and rural development), and representatives of the Catholic and Methodist missions in order to ascertain if, in their opinion, VLOM management would be feasible in the area (see Annex A for List of Persons Contacted).

Baseline data was then collected at the village and institutional level in the sub-region to survey and assess factors impinging on the development of an appropriate O&M system and to determine the requirements for such a system. A number of surveys were conducted to obtain the necessary data.

- A socio-economic survey was carried out in 20 villages located throughout the three zones to assess the socio-economic potential for a VLOM system. An example of the questionnaire used is found in Annex B.

- In order to determine the availability of rural artisans who could be repairmen in a VLOM system, 16 rural artisans were interviewed to determine their experience, previous training, availability of tools, income and interest in being trained as repairmen. The questionnaire used is included in Annex C.

- A survey was conducted to determine the possible effectiveness and interest of the commercial networks to distribute spare parts. Representatives of Methodist and Catholic missions were also interviewed to determine their willingness in setting up a self-sustaining distribution system for spare parts. See Annexes D and E for questionnaires used.

- Finally, discussions were held with health officials and existing health personnel at medical centers and dispensaries in the area to determine what type of health education activities related to water and sanitation were currently being carried out, and whether or not the existing health personnel would be willing to carry out health education in project villages.

Based on the analysis of the data, a VLOM system was designed including training and institutional development components. Final discussions with AID, AIDR, and SNHR were held to get their feed-back to the proposed VLOM system.

Chapter 3

DEVELOPMENT OF AN OPERATION AND MAINTENANCE SYSTEM

3.1 Approach

The National Rural Water Supply Policy and Strategy Statement states that the management and maintenance of rural water supply systems is solely the responsibility of the user community, as represented by a water committee to be trained and guided by SNHR, PNA (Programme National d'Assainissement), or a non-governmental organization. In view of this policy statement, the low population density, the vastness of the Lualaba Sub-Region, and the exorbitant cost of a mobile maintenance brigade in those circumstances, it has been accepted by all implementing agencies that the VLOM approach is best suited to ensure the continued functioning of the water supply systems installed by the project.

In this chapter the various factors impinging on such a system will be analyzed to determine the requirements for training and community organization, provision of equipment and materials, institutional development, and project staffing.

3.2 Requirements

A VLOM system normally requires:

- The selection of hardware that is appropriate given the technological and recurrent cost levels that can be managed by the system users.
- A community organization which fully understands all management principles and tasks to be performed and is capable of collecting and managing a fund at the community level to cover the recurrent costs of O&M of the water supply system and ultimately its renewal costs.
- Sufficient awareness on the part of the population regarding the importance to their health and well-being of an improved water supply system and an adequate knowledge of the system's operation.
- The availability of one or more qualified caretakers at the village level who can ensure the correct day-to-day operation of the system and perform minor preventive maintenance.
- The availability of skilled and equipped artisans to provide services for all major routine repairs at a reasonable cost.
- The availability of spare parts at a reasonable cost to the users and at a reasonable distance from the community.

The successful collection of village funds as a requisite for selection of a village for a water system is not a trivial matter. Questions such as "who collects and when," "what if the villagers will not pay, and "who can control and oversee this collection," come to mind. In answering these questions, several guiding principles should be adhered to. First and foremost, a sense of ownership and responsibility for the system (from construction to proper use and operation and maintenance) should be maximized at the village level. This can be fostered in a village by appropriate training and health education as indicated in this report, but ideally, it would be a heavily weighted item in criteria for choosing a village in the first place. Experience has shown that the best predictor for this level of community participation in water supply and sanitation projects is previous community organization of some sort, e.g., a previous history or tradition of self-help or participation in a local problem-solving project, a dynamic and respected community leadership, social cohesion among leading households in the community, and a viable organized structure to serve as a vehicle for community participation/organization. (Ref. 8)

Second, authority for operationalizing all aspects of the water system components would best come from the community itself. That is, this authority should be well understood, accepted and respected by persons using the systems. This often involves a complex set of social interactions, some of which are not completely understood by non-villagers. The authority could include, however, the village chief, the elders, the water committee, etc. Again, it is better to select villages on the basis of these factors rather than to try to foster them de novo. In any case, external authority (police, etc.) should be avoided. Two possible exceptions to the use of external (police, etc.) authority are in the prevention of levying additional user fees by village officials and the use of churches for keeping villagers' money if local "treasurers" aren't found acceptable.

3.3 Technical Analysis

3.3.1 General

The planned outputs of the project are the following:

- 500 springs will be capped to provide water for washing and cassava soaking.

- 140 dry wells will be rehabilitated, and 430 new borehole wells will be installed. All 570 wells will be equipped with handpumps. It is anticipated that 500 villages will each have a capped spring and one or two wells with a handpump.

- 7 piped water distribution systems will be installed to serve one rural town and a number of medical facilities and schools in the sub-region. Systems will be based where possible on gravity flow and in some instances on renewable energy powered pumping systems. (see Section 3.3.6 for details on this).

During the field study it was observed that the demographic situation and the availability and type of water points does not correspond to the information

contained in the project paper. Many communities rely on streams and rivers for their water supply, and no springs could be found nearby. Furthermore many villages are so small that one water point would be sufficient. Whether this should be a spring catchment or a well equipped with a handpump would depend on the hydrological situation in the immediate area, the community's preference, and its ability to provide for the operation and maintenance of the handpump (see Section 3.6).

At present, AIDR and SNHR are considering expanding all seven water distribution systems to villages and towns close to the medical facilities and schools to be served. This would require a higher investment in these systems but would reduce the need for well rehabilitation and possibly some borehole construction and spring capping. It would also reduce the O&M requirements for the communities involved, since piped water systems generally require less maintenance than handpumps.

3.3.2 Spring Catchments

In terms of O&M, spring catchments are the simplest and most appropriate water supply systems envisaged by the project. If the spring catchments have been well constructed, O&M activities would be limited to the following:

- Maintaining the fence and runoff diversion ditches above the spring.
- Preventing trees and bushes from growing in this protected area.
- Ensuring the cleanliness of and proper drainage from the water-collecting area and any laundry and bathing facilities that may be constructed near the spring.

In some instances because of the state of the aquifer and topographical situation, reconstruction of the catchment filters is necessary after a period of several years. The project should, as much as possible, avoid improving such springs.

3.3.3 Rehabilitation of Existing Wells

It is planned to rehabilitate 140 existing wells in the project area. Most of these wells were constructed by the Fonds de Bien-etre Indigène (FBI) in 1951-52 or by AIDR in 1965-67. Heavy cast iron pumps were originally installed on these wells. However, when AIDR left the area, almost all pumps eventually broke down because trained maintenance personnel and spare parts were lacking and user communities felt no responsibility for O&M. At present, many of the wells are unusable, either because the remaining superstructure has covered up the well, or because the well has silted up or caved in.

There are basically two types of wells. One type is fully lined in concrete and has a concrete apron, head wall, and pump platform. The other type is not lined and has only a concrete headwall and apron and a pump platform, which in most cases has been removed. As was observed in several cases, the unlined wells have more of a tendency to silt up or cave in than the lined wells. Any

rehabilitation should focus, therefore on fully lined wells. O&M requirements for rehabilitated wells include:

- Ensuring the cleanliness of the area around the well -- especially the apron, drainage ditch, and any facilities for watering animals.
- Preventing mud puddles from forming and stagnant water from collecting near the well.
- Periodically cleaning the bottom of the well (removing silt).
- Repairing cracks in the lining, headwall, cover, apron, and any other well structures.
- correctly operating and maintaining the pump (see Section 3.3.5).

3.3.4 Borehole Wells

Because the useful life of a borehole and the leather cup seals of the pumps greatly depends on the quality of the borehole, quality control will be very important during construction. Once constructed, the borehole well itself does not require any maintenance. However, it may have to be relined after one or more decades. The following operation and maintenance procedures are essential:

- Ensuring the cleanliness of the apron, drainage ditch, dry well, and any facilities for watering animals.
- Preventing mud puddles from forming and stagnant water from collecting near the well.
- Correctly operating and maintaining the pump (see Section 3.3.5).

3.3.5 Handpumps

It is planned to install handpumps on all rehabilitated wells and new borehole wells. This is a sound decision, for field work has shown that people generally don't drink water from open wells in the villages (see Section 3.6). The pumps selected for installation[1] are the VLOM modified India Mark II manufactured by Richardson and Cruddas, India. More than 500,000 India Mark II pumps have been installed worldwide, and recent studies of the World Bank

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[1] Another pump considered was the locally-manufactured RCBF pump. However, this pump is unsuitable for two reasons: first of all, the minimum cylinder diameter is 150mm while the diameter of the lined borehole is only 100mm; secondly, while the pump has performed well in family situations (up to 100 users) it is deemed not sturdy enough for village use for the time being. The newly modified version of the Mark II pump has an important advantage: the piston and foot valve can be extracted for repairs without having to lift the entire riser-pipe assembly, which was the major stumbling block for village repairmen.

confirm that the pump can withstand heavy-duty use. In part this is due to an excellent quality control system, managed by an independent engineering firm.

To date 42 India Mark II pumps of the initial design have been installed by SNHR with UNICEF assistance. However, because of the maintenance problem cited above and the lack of spare parts, at present none of the 42 pumps are functioning. Thirty seven have worn leather cup seals and five various other problems.[2] UNIDO (U.N. Industrial Development Organization) and UNICEF efforts to produce leather cup seals locally have thus far not advanced to the manufacturing stage. Therefore, for the foreseeable future, any VLOM system in Zaire should be based on imported spare parts and an effective internal distribution system.

The installation of India Mark II pumps on rehabilitated wells presents a potential problem. The pump design is based on a minimum well depth of 25 meters. At shallower depths the weight of the pumprod is insufficient to easily lower the piston in the cylinder after each stroke (weight is required to keep the chain taut). This problem can be overcome for depths of 15-25 meters by installing larger diameter pumprods. Most existing wells, however, have a depth of only 10-15 meters.

The following spare parts will be needed for one modified India Mark II pump in a five-year period of operation:

	ITEM	QUANTITY
1.	Hexagonal bolts 12x1.75x40 mm	16
2.	Hexagonal nuts 12x1.75 mm	32
3.	Washer 4 mm thick	4
4.	High tensile bolts 10x1.5x490 mm	3
5.	Nylock nuts 10x1.5 mm	5
6.	Handle axle	1
7.	Bearing (6204 2Z)	6
8.	Chain with coupling	3
9.	Bolt for front cover 12x1.75 mm	2
10.	Rubber washers	10
11.	Leather sealing rings	18
12.	Rubber seating (big)	5
13.	Rubber seating (small)	5
14.	Rubber O rings	5
15.	Upper valve guide	2
16.	Upper valve seat	2
17.	Upper check valve guide with retainer	1
18.	Connecting rod	4
19.	Couplers	2

Other major pump parts, such as the cylinder body with sleeves, top and bottom caps, head assembly, stand assembly, check valve assembly, plunger assembly

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[2]Oral communication, Mr. Vandenberghe, UNICEF representative.

and riser pumps, have an average life span of 20 to 25 years, while the handle assembly and plunger rod should last 10 to 12 years.

The following tools and supplies would be needed in the community to provide minor preventive maintenance:

2 Stilson wrenches (crank spanner) 17x19 mm
1 wire brush
grease or oil
paint
sandpaper
hoe

The O&M tasks to be performed at the community level would include the following:

- Ensuring the correct use of the pump by all users.
- Weekly greasing of the chain.
- Tightening and/or replacing bolts and nuts of the superstructure when required.
- Removing rust patches.
- Painting unprotected spots.
- Diagnosing pump performance problems and arranging for pump repairmen visits
- Collecting and managing the pump maintenance fund.

Common repairs would be the responsibility of a trained pump repairman. Such repairs would include replacing worn leather cup seals and other gaskets and replacing pumprods, couplings, the chain, the axle, bearings, sockets and, if necessary, the handle assembly. He also should be able to extract any pumprods with the piston from the riser pipe if a pumprod coupling becomes unscrewed or a pumprod breaks.

The following tools and supplies would be needed by a pump repairman:

	ITEM	QUANTITY
1.	Stilson wrench (crank spanner) 17x19 mm	2
2.	Coupling spanner	1
3.	Handle axle punch	1
4.	Connecting rod holding device	1
5.	Connecting rod lifter	1
6.	Chain coupling supporting tool	1
7.	Rebar hook with rope to lift fallen pumprod section	1

Finally, some non-routine repairs may need to be carried out on a pump. For example, the riser main may get disconnected, or the cylinder lining may get

damaged. These repairs will need to be performed by a well equipped and well trained team capable of lifting the riser main. Church based garages with qualified mechanics (one in each of the three zones) could provide this special maintenance back-up service if properly trained and equipped. They would need to be provided with a complete pump installation tool kit, a tripod, and a winch. A pump installation brigade will be established at the SNHR station in Sandoa during the project. During the life of the project, the brigade might provide such special maintenance.) Such a team could also provide such services as re-threading damaged pumprods and couplings, welding broken pump bodies, and completely overhaul pumps. However, correct and secure pump installation should prevent many of these non-routine breakdowns.

3.3.6 Piped Water Distribution Systems

The project provides for installation of seven piped water distribution systems. A pre-feasibility study has been made for all systems, and the project management team proposes to increase the number of villages and neighborhoods to be served by these systems so as to lower the per capita investment costs.

In all cases distribution has been planned by gravity flow. The systems in Kasaji and Musumba will depend on a micro-hydro plant, however, to allow spring water to be pumped from a valley up to a higher elevation from where it can be distributed by gravity flow. In Katoka the installation of a turbo-pump is foreseen while in Kafakumba the water for the hospital and Catholic mission is to be pumped from the village reservoir into an overhead tank by solar power.

The source for all these water supply systems will be spring catchments, and it is anticipated that no treatment will be necessary. Depending on the quality of the spring, a settling chamber may have to be installed just downstream from the spring catchment.

In general it is true that gravity-flow water supply systems require relatively little maintenance. Also the per capita O&M costs are lower than for handpump systems. However, because the planned systems will affect a larger number of villages, neighborhoods, and institutions, the user organization will have to be more complex and will require better technical and financial management. The day-to-day operation of these distribution systems needs careful supervision by one or more employees to ensure that all users will have equal access to water. A simple broken tap in one place can drain away a large part of the available water at the expense of all other users.

Before systems are installed the project management team and the beneficiary communities should decide whether or not to install water meters and choose between public and private connections. These decisions will affect people's attitudes and thus the ensuing O&M requirements. Continued maintenance of drainage ditches and a dry well for spilled water will also be necessary.

It will be essential for the community organization in charge of O&M to have a detailed plan of the entire water supply system so that the pipe and valve sizes are known if replacement of a leaking section becomes necessary.

Daily inspection of all water distribution points is useful and, in the case of public standpipes, absolutely necessary, so that problems can be corrected immediately. Once a week the entire system should be checked for leaks. If water meters are installed, they should be read on a monthly or quarterly basis. As water meters tend to become inaccurate after about five years, plans should be made for their replacement.

Settling chambers should be checked weekly and cleaned out if necessary. The most routine repairs will involve the replacement of taps or tap washers. The useful life of taps and washers has been extended in some areas by shortening the handles. Valves should be checked semi-annually. Valve handles tend to be misused or to rust and therefore should be kept in storage where only maintenance personnel have access to them.

The following tools and supplies will be required by the O&M personnel:

pipewrench
open-end wrenches to fit taps and valves
adjustable wrench
hacksaw and blades
joining compound
PVC solvent cement
spare PVC pipes
spare taps, washers, sockets, elbows, tees, etc.
cement
trowels, hoes and shovels

Since the pumping equipment and micro-hydro turbines have not yet been selected it is not now possible to provide a list of required tools, spare parts, and O&M duties for the pump assisted water systems. This should be undertaken by the project manager once the equipment is selected.

O&M requirements for the civil works of the micro-hydro plants will include frequent cleaning of the headrace, settling basin, and tailrace.

3.4 Infrastructure and Institutional Analysis

The present population of the Lualaba Sub-Region is estimated at approximately 395,000 people dispersed over an area of almost 80,000 square kilometers. The majority of the population lives in villages and hamlets along primary and secondary roads. (For a detailed description of the project area and its population please refer to the project paper.)

Presently functioning water supply installations are limited to two REGIDESO systems in Dilolo Gare and Sandoa and several smaller systems serving Catholic and Methodist missions and hospitals.

Roads in the sub-region are generally good, although bridges and passages through valleys are not always negotiable by larger trucks or even ordinary vehicles, especially on secondary roads in the rainy season. Moreover, in the Kapanga Zone, at the time the field work was conducted, there was a bridge under construction and a ferry was out. Traffic is light due to a low population density and the limited economic activity in the area since the

events of 1977-78. Very few public services have vehicles at their disposal, and even traders have fairly limited transport capabilities. Once a week there is a train connection from Dilolo Gare and Kasaji to Lubumbashi.

3.4.1 Administrative and Social Services

Administratively the sub-region is subdivided into three zones: Kapanga, Sandoa, and Dilolo, which in turn are subdivided into collectivités and/or groupements.

Besides of governmental administrative, political, and security services, the Ministry of Agriculture has a sizeable number of agronomists, veterinary doctors, and extension agents in all three zones who deal mostly with technical issues and animal health.

In Sandoa, Dilolo Gare, and Kisenge there are Ministry of Health-run hospitals. The Catholic Church operates hospitals or dispensaries in Kapanga, Kalamba, Sandoa, Kafakumba, Dilolo Poste, Kasaji-Lueo, and Kisenge. The Methodist Church operates the Samuteb Hospital in Musumba and some 50 dispensaries and health posts throughout the sub-region. Consultation and treatment is paid for by the patients, but the amount paid usually does not cover the costs of services and drugs. The churches procure their medicines usually overseas through the Cooperation Belge in Lubumbashi. Primary health care outreach is limited to an emerging program of the Methodist church in the Kapanga Zone.

All towns and many of the larger villages have primary and sometimes secondary schools, sometimes with limited boarding facilities. Schools are operated by either the government or the churches. There is an agricultural training center in Buninge near Kasaji, and the Methodist Church operates a technical school in Mwajinga with departments for agriculture and auto mechanics.

3.4.2 Commercial Infrastructure

The commercial network is limited to retail stores in Musumba, Sandoa, Kafakumba, Dilolo Poste, Dilolo Gare, Kisenge, and Kasaji. Stores usually carry clothing and foodstuffs, and a number also sell dishes, hardware,and spare parts for bicycles.

A survey of 13 stores in the sub-region was conducted to determine the possible effectiveness and interest of the commercial network to distribute spare parts for pumps. Stores that carried spare parts for bicycles were selected.

The availability and prices of four randomly selected spare parts (inner tubes, spokes, pedals, and saddles) were checked in each store. Only two stores (15 percent) had all four parts in stock, while an additional six stores (46 percent) had three out of four parts in stock. Prices fluctuated from zone to zone with Sandoa being approximately 8 percent more expensive than the Kapanga and Dilolo zones.

The average price mark-up in the sub-region over Lubumbashi wholesale prices was evaluated at 46 percent. Commercially the Kapanga Zone is mostly oriented towards Kananga (380 km) while Sandoa, Kasaji and Dilolo get all supplies from Lubumbashi, mostly by train. One factor complicating the possible stocking of spare parts for pumps is the absence of trading links between the area and Kinshasa, where the import company representing the pump supplies would most likely be located.

3.4.3 Institutionalization of Spare Parts Distribution System

The project will establish a sub-regional station for SNHR in Sandoa. At this moment it is not certain, however, how many SNHR brigades (if any) will remain in Sandoa when the project funding runs out in 1990. Thus far, SNHR has not been able to set up any kind of spare parts distribution system in the country and, although this may change in the future, it was not judged likely. The initial stock of spare parts, however, could easily be brought to the area by the project, along with the pumps.

The SANRU II project envisages that the medical reference centers of the rural health zones, which to date are mostly church-run hospitals, will be responsible for ordering and distributing spare parts for water supply systems.

In the project area shopkeepers show relatively little interest in carrying spare parts for pumps. The owner of Ets Rufino, the only chain of stores in the area that carries a fair number of bicycle spare parts (with four stores in the Dilolo and Sandoa zones), proposed to delegate the responsibility of distributing spare parts to the churches, given the low volume, uncertainty of sales, and the service character of such an operation . This proposal was considered feasible by many Zairian government representatives, villagers, traditional chiefs, and the church representatives themselves.

A survey of seven missions and church stations in the sub-region revealed that all were interested in participating in a self-sustaining distribution system for pump spare parts, but none of the missions/stations were able to make a commitment, as participation would be dependent on a policy decision at the diocese level. However, given their tight financial situation and the range of development activities that most missions/stations are already engaged in, it would be impossible for them to make the investment in an initial stock of spare parts.

The missions/stations have external trading links only with Kolwezi and Lubumbashi; supplies from abroad are usually ordered, imported, stored and trans-shipped by Cooperation Belge in Lubumbashi. Discussions were held with the logistics coordinator of the Cooperation Belge in Lubumbashi who agreed in principle that their services could also be provided for spare pump parts.

3.4.4 Banking

There are no banks whatsoever in the entire sub-region. While some informal savings arrangements exist for employees and others at some of the Catholic missions, the number and volume of accounts is down since few people are able to save money lately.

3.4.5 Repair Services

Very few garages exist in the sub-region and all are connected to either a mission or church station, a trading establishment, the army or the mining company in Kisenge. Bicycle repairmen and blacksmiths can be found in most larger villages but few of them are qualified to repair motorcycles.

3.5 Financial Analysis[3]

3.5.1 Present Water Supply Costs

At present the only communities enjoying the benefits of an improved water supply system are the inhabitants of Dilolo Gare and Sandoa where REGIDESO operates water distribution systems. All water use is metered and the following charges apply (nationwide):

Type of Service	Volume/Month	Cost
Private connections	0-10m^3	2.21Z
" "	10-30m^3	5.64Z
" "	30-30m^3	8.95Z
" "	More than 100m^3	12.97Z
Commercial connections		16.22Z
Industrial connections		20.86Z
Government connections		20.50Z

REGIDESO has a total of 312 individual connections in Dilolo Gare and 266 in Sandoa. Before a connection is installed the subscriber has to pay a 300Z guaranty in town or a 150Z guaranty if he lives in an outlying neighborhood. Many subscribers provide water to their neighbors and at the end of the month the amount to be paid is divided by the users.

In Dilolo Gare in 1984 REGIDESO invoiced a total of 128,213m^3 for the amount of 2,224,173Z. This amounts to an average cost of 17.35Z/m^3. The average cost is high because the customers are mainly government services and the SNCZ (the railway).

It is estimated that the average household (six to seven people) uses 6m^3 per month at a cost of 53.70Z, based on the assumption that 10 households share one private connection. It cannot be assumed that all households in the sub-region could afford this amount for water supply each month, as the economic activity in most of the area is more limited than in Dilolo Gare (see also Section 3.6).

The annual operating costs of REGIDESO in Dilolo Gare amounted to approximately 1,150,000Z in 1984. The theoretical net profit would therefore amount to more than one million Zaires. However, the REGIDESO station in

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[3] See Annex F for financial calculations.

Dilolo declared that it just managed to break even as all GOZ invoices are paid directly to REGIDESO in Kinshasa. The breakdown of operating expenses is as follows: salaries for seven employees, 44 percent; electricity for pumping, 47 percent; miscellaneous costs, 9 percent.

At present, people in other towns and villages don't pay cash for their water supply, except in villages where people draw water seasonally from existing wells with a rope and bucket for laundry and brick-making purposes.

3.5.2 O&M Costs for Spring Catchments

If a village is well organized, all tasks described in Section 3.3.2 could be performed on a voluntary basis and cash outlays would be limited to an occasional bag of cement every one to two years to repair damaged walls, spring boxes, or drains. Given the limited amount of money involved, a maintenance fund would not be required.

3.5.3 O&M Costs for Wells and Pumps

If a village is well organized all tasks described in Section 3.3.3 relating to the large diameter wells could be performed on a voluntary basis. O&M supplies needed for handpump maintenance include grease, sandpaper, and paint. The annual costs of these supplies and cement for repairing cracks (see Sections 3.3.3 and 3.3.4) is estimated at 500Z per year.

The average annual costs of spare parts for the handpumps are as follows:

Spare parts costs CIF Matadi	2,341Z
Customs clearance tax, transport Matadi-Kinshasa import agency mark-up: 75 percent	1,759Z
Air freight and handling Kinshasa-Lubumbashi (3,000 kg per year for 500 pumps)	270Z

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[4] It should be noted that discussions held with AIDR and SNHR which took place subsequent to the writing of this report revealed that according to AIDR and SNHR the costs for customs clearance tax, transport Matadi-Kinshasa, and the shipment of the parts from Kinshasa to Lualaba might be lower than those listed above if SNHR/AIDR were in charge of this operation. Rather than airfreight the parts to Lubumbashi and transport them by railroad on to Lualaba, SNHR-AIDR proposed transporting the parts by road directly from Kinshasa to Sandoa. If so this could reduce the total annual spare parts costs to 4,600Z (as opposed to the 5,350Z mentioned above). While this is possible during the life of the project, it is felt that when AIDR leaves the Lualaba Sub-Region and SNHR's presence will be strongly reduced at the completion of the project, this may not be a workable long-term solution, given the absence of any direct transport system from Kinshasa to Sandoa.

Rail/road transport and handling Lubumbashi-Lualaba	90Z
Subtotal	4,460Z
Mark-up by churches to cover administrative costs and risk factors: 20 percent	890Z
Total annual spare parts costs	5,350Z[4]

Replacement of major spare parts as described in Section 3.3.5 will add significantly to annual operation and maintenance costs after the fifth year of the pumps' operation. The cost of these major parts is estimated at 5 percent per year of the pump investment costs, marked-up 200 percent for duty, transport, and profit, yielding a total of 2,800Z per year. Thus, the total annual spare parts cost after the fifth year will be 8,150Z.

Whether the villagers themselves perform minor preventive maintenance tasks or pay a management service to perform them will be determined by the community itself. For cost calculations it is assumed here that maintenance would be a voluntary service.

Repair services carried out by the pump repairmen will be paid for by the village. Data on daily wages of bicycle repairmen was inconclusive, but the average wage for a full day's work is estimated to be 100 to 150Z. Given the fast rising prices and wages in the sub-region and the fact that repairmen will often have to travel to repair pumps, cost calculations are based on a daily wage of 200Z, although competition between the pump repairmen may bring the amount down. Given an average number of five working days per year for routine pump repairs (including travel) the labor cost would amount to 1,000Z/year per pump.

In case of a serious pump breakdown or non-routine malfunction which cannot be repaired by a local pump repairman, the maintenance back-up services of a church mechanic or the SNHR pump installation brigade would be needed. In such an event the village would have to collect additional funds to pay for the transport of the equipment, labor, and spare parts. This is expected to happen more frequently after the fifth year of operation.

The annual O&M costs for a well and a handpump can be summarized as follow:

Item	Years 1-5	Years 6-25
Supplies (grease, paint, cement, etc.) and caretaker's tools	500Z	500Z
Spare parts	5,350Z	8,150Z
Pumps repairman labor	1,000Z	1,500Z
Total	6,850Z	10,150Z

3.5.4 Piped Water Distributions Systems

The price of O&M for locally-managed water distribution systems depends on how well users care for the system; costs vary from system to system. A pump-assisted system requires more spare parts and higher qualified full time personnel than a gravity-flow system. The annual O&M costs for locally managed systems are approximately 1 percent of the initial investment costs for gravity-flow systems and 2 percent for pump-assisted systems.

The annual O&M costs for a gravity flow distribution system can thus be estimated (in the case of Mwajinga/Sandoa system) at 0.78Z/m^3 or 61Z per household, assuming a household of seven people and a system used at 67 percent capacity. The annual O&M costs for a pump-assisted water distribution system (using renewable energy as in the case of Kasaji) can be estimated at 1.75Z/m^3 or 122Z per household, using the same assumptions. These rates are considerably lower than those charged by REGIDESO. They are possible because of lower personnel requirements and no pumping and treatment costs. However, solid community organizations will be required to manage these systems.

3.5.5 Investment Costs for the Establishment of a VLOM System

The main investment costs relating to the establishment of an O&M system concern training people at all levels, equipping caretakers and repairmen, purchasing an initial stock of spare parts, providing storage facilities, and meeting regular project staffing and operation costs. It is expected that these investments will be covered by the project and not by the project beneficiaries (except for the caretakers' and repairmen's tools, which will be paid for by the village or repairmen, respectively).

3.5.6 Renewal Cost

No studies were conducted to determine the future renewal costs of the systems. At present the socio-economic situation is such that amortization of water supply systems is not financially feasible for the user communities, except maybe in the case of spring catchments.

3.6 Socio-Economic Analysis

3.6.1 Implications of Recent Demographic Changes

The present population of the Lualaba Sub-Region is estimated at approximately 395,000 dispersed over a vast area of almost 80,000 square kilometers. Large portions of the area are uninhabited, with the majority of the population living in towns, villages and small hamlets along primary and secondary roads. The sub-region is characterized by a low population density of only five inhabitants per square kilometer.

Extensive demographic movements in the sub-region during the past eight years have resulted in the disappearance and, in some cases, the relocation of some smaller hamlets and villages and a marked increase in population growth of many of the larger villages. These phenomena are particularly marked in the

Dilolo zone. During the field work there, it was observed that a large number of villages shown on the map no longer existed; in some cases a village had resettled in a location some 20 to 30 kilometers farther away. The only maps available are those of the National Geographic Institute, and these have not been updated or revised to show these population movements. Therefore, the present location of villages will have to be verified before any extension work can commence in the villages.

A further problem posed by the extensive demographic movements is the difficulty of obtaining current and reliable information on village size and population. While the project paper gives some 395,000 as the sub-region's total population, local authorities contacted gave estimates of 350,000 inhabitants. Although a census was conducted in 1984, the results will not be available for some time.

According to the project paper, the project will serve 500 villages. Each will receive an improved water supply consisting of one capped spring and one to two wells with handpumps all together providing each inhabitant 30 liters of water per day. However, the project's selection criteria and water supply allocation criteria are based on an outdated analysis of the existing demographic and hydrological situation and existing types of water supply points. The village selection criteria are based on the assumption that the villages in the project area vary in size from 300 to 500 people. The truth is that, while there are many small villages and hamlets with fewer than 300 inhabitants, there are many with 1,000 or more. Of the 20 villages visited during the survey, 9 villages or 45 percent had more than 500 inhabitants, and 7 villages or 35 percent had more than 1,000 inhabitants. There are an estimated 800 villages in the project area ranging in size from hamlets and small villages of fewer than 300 inhabitants, to large villages of 3,000 to 4,000 inhabitants.

Many communities rely on streams and rivers for their water supply and no springs could be found nearby. Of the 20 villages surveyed, only 3 or 15 percent had springs which could be found nearby.

It is not known what the total number of villages is or what the total water supply demand is in terms of number and type of improved water supplies. However, we do know that the project has only 500 handpumps to install on wells or boreholes and can provide 500 spring catchment systems. It may be possible to include more villages in piped distribution systems, thereby reducing the number of spring catchments and wells or boreholes with pumps, but many of the larger villages of 2,000 inhabitants or more are not located near a planned piped distribution system and can be served only by wells or boreholes with pumps. In order to meet the water supply needs for villages of 2,000 six to eight handpumps would be necessary. If the total demand for handpumps exceeds the supply, as seems likely, the project will have to make a policy decision as to whether it will aim to cover as many villages as possible or to provide complete coverage to each village selected. Problems arise if a water supply system does not meet village demand. Overused handpumps break down more frequently, and, if there are long waiting lines, conflicts can arise over access rights which eventually can lead to the villagers' refusal to contribute to the handpump's repair.

Before villages can be selected for improved water supply, reliable and current information as to their population and their existing water supply points must be obtained. Only then can norms regarding the number and type of installations per village be determined and applied.

The final decision on improving old and installing new water points should depend on the existing water supply points and hydrological situation, the community's preference, and the community's ability to provide O&M for the water supply system(s) in questions.

3.6.2 The Village Survey

A socio-economic survey was conducted in 20 villages located throughout the three zones in the project area to determine the existing water supply and demand. An assessment was then made of the community's willingness to improve and maintain its water supply system its capacity to manage, maintain, and support the maintenance costs of various types of improved water supply installations. (Please refer to Annex B for the list of villages surveyed and the survey questionnaire.) Table 1 (Section 3.6.8) shows the villages' socio-economic potential for VLOM.

The villages were selected in a random sample, although an attempt was made to include both villages close to or on a primary or secondary road and those on a tertiary road or not easily accessible so as to have a means of comparison.

3.6.3 Existing Water Supply Situation

For three of the villages, springs at a distance of 500 meters downhill were the only water supply source; for the remaining 17 villages rivers and streams at an average distance of 1 to 1.5 kilometers were the main source. Women collect drinking and cooking water from holes dug alongside the rivers and streams that they maintain regularly to ensure the water's quality. Bathing and laundry is carried out directly at the river or stream, or water is collected there for those purposes.

FBI/AIDR cement-lined wells were found in seven of the villages; however, only two were in use. Two were dry, and three were equipped with handpumps which were not functioning. These wells are not used as a potable water source, as rubbish is sometimes thrown into them; they are used mainly for other purposes, such as brick-making, laundry, and bathing. We asked if they had ever used the handpumps as a potable water source, several villagers expressed a preference for the taste and temperature of water collected from a spring or water hole to that from a handpump. Traditional wells were found in a few villages; however, these were dug for purposes of brickmaking.

This project is built on the assumption that the user population will appreciate the convenience of an improved water supply and use it as a potable water source. However, in light of current water use practices, even if health education activities are carried out to develop an awareness of the benefits of the improved water supplies as a potable water source, women may continue their current practices and use the handpump not for drinking water, but for bathing, laundry, or brickmaking.

All the villages identified water quality and quantity, particularly at the end of the dry season, as problems. The inaccessibility of their water supply was also cited as a problem for those villages whose water supply was a river or stream. While all the villages identified water supply problems, one village did not consider the improvement of its water supply a felt need. The construction of a dispensary or a school in the village were more important priorities. For this village, a borehole with handpump would have been the only feasible water supply technology, and in light of the high management and maintenance requirements, particularly the maintenance costs, the villages preferred to allocate their scarce resources to other village priorities, in spite of the fact that their only water source was a river located 1.5 kilometers away.

During the survey, villagers were presented with various water supply options, based on their village's population, spatial distribution, existing water points, and hydrological situation. In two of the small villages (fewer than 300 inhabitants) with springs, the villagers were given the option of a spring catchment system or a borehole with handpump. In both cases, they expressed a preference for a spring catchment system in light of the lower management and maintenance requirements and costs.

In the third village with a spring, 450 of the 500 inhabitants lived in the main center of the village and the remaining 50 people lived in a hamlet three kilometers from the center. Since a water supply system installed in the main village would not serve the needs of users in the hamlet, two separate water supply systems would be necessary. The villagers in the hamlet expressed a preference for a spring catchment system, as they did not feel they could support the maintenance requirements of a handpump, while the main village expressed an interest in one to two boreholes with handpumps. This case underlines the necessity of considering not only the population or the number of users when assessing a community's water supply needs, but also taking into account the spatial distribution patterns of the user groups.

Three villages, each with more than 1,000 inhabitants, were given the option of receiving boreholes with handpumps or being served by piped water distribution systems. All three preferred the piped distribution systems (public standposts with taps) because of the level of service and low maintenance requirements and costs.

In the remaining 14 villages the only option was rehabilitation of an existing well and handpump or installation of a borehole with a handpump. All but one of the villages expressed an interest in a rehabilitated well with a handpump and/or boreholes with handpumps (with one of these 14 villages not being interested in an improved water supply); three of the villages, because of their small size (all with fewer than 250 inhabitants), would probably not be able to support the long-term maintenance costs of a handpump (see Table 1). All of the villages also expressed an interest in the construction of additional water facilities such as laundry facilities or animal drinking troughs.

3.6.4 Financial Capacity for VLOM

An assessment was made of each community's economic revenue base and its financial capacity to support the O&M costs of the water supply systems in question. (These costs are calculated in Section 3.5.)

A relationship was found between the population size of a village and its economic revenue base. All the villages in the survey with fewer than 250 inhabitants (six villages) had mainly subsistence economies (manioc production). They obtained cash from the sale of surplus manioc or corn or from game meat. Only in two instances did the villagers cultivate cash crops of cotton or tobacco. Moreover, no artisans or salaried people, such as school teachers, nurses, etc., lived in these smaller communities. Some have been especially hard hit by the falling market price paid for corn. UNHCR provides corn flour to refugees in the camps, however, some of this corn flour has been sold on the open market in the area, thus lowering the price for locally-grown corn.

It was observed during the field survey that villages located in the area south of Dilolo Gare bordering with Angola are all experiencing a high rate of emigration as a result of increased military activity in neighboring Angola. The lack of security and accompanying instability were the major reasons given.

In view of the high recurrent costs for handpump maintenance, villages of fewer than 250 inhabitants will probably not be able to support such maintenance. However, the actual capacity and willingness of a particular village to contribute will have to be determined during the village extension work.

A village's financial capacity and economic revenue base increase in proportion with its size. Most of the villages with more than 250 inhabitants produced a cash crop of cotton, tobacco, peanuts or sesame. The number of artisans increased in proportion to the size of the village. All of the villages with more than 1,000 inhabitants (seven in total) were important commercial centers with a market and shops. The number of houses constructed with baked bricks and with tin roofs also increased in relation to the community's size.

It was not possible to obtain exact data on each community's financial revenue. However, all but one of the villages that expressed an interest in improving their water supply, when informed of the annual O&M costs of the water supply system in question, expressed a willingness to support the proposed maintenance costs and felt they could afford them.

In addition to assessing individuals' sources of income, data were collected on revenue from communal enterprises. While none of the villages had an agricultural cooperative, five had cultivated a collective field of manioc. This money was not intended for village use but rather was to pay the village's obligatory contribution to the "Mwant Yav" (a high chieftain or king) for the construction of a pedagogical training institute in Musumba.

While population size was an important variable, the location of the village -- whether it was situated on a primary or secondary road -- and its proximity

to a market town or commercial center are also variables having an influence on the economic development of a community. The major economic activity is the sale of agricultural produce, and as there are limited transport possibilities, villages located further away from a market town or off a main road are at a disadvantage.

Of the three zones, Dilolo zone, particularly the villages located on the East-West road and rail axis between Dilolo Gare and Kolwezi, had the highest level of economic activity in general.

A characteristic common to all villages surveyed is the seasonal availability of cash, as their main sources of income is derived from the sale of agricultural produce.

3.6.5 Ability to Collect and Manage a Maintenance Fund

In assessing the community's financial capacity for VLOM, its ability to support the maintenance cost is as important as its ability to collect and manage a water supply maintenance fund.

In determining the village's experience in collecting and managing a fund, a distinction was made between a fund collected for an obligatory official purpose to be given to the local administration, and a fund collected for village use. All of the villages had collected and contributed money for official purposes, but only 12 villages or 60 percent, had collected a fund for a village activity and had used a community member as treasurer of the fund. In 8 of these 12 villages or 40 percent, the Mouvement Populaire de la Révolution (MPR) Committee president or treasurer or the village chief had acted as treasurer. Community members contributed for an activity that benefited the general good, such as the construction of a primary school, dispensary, health post, MPR office, or for the reception of visitors. The average amount collected from men and women was 10Z to 15Z. In the remaining 4 villages, a particular interest group, such as a religious denomination led by the pastor, had collected a fund from its members for the construction of the church or for a religious ceremony. The contribution each member gave depended on his or her individual circumstances, as the contribution was in the form of a donation. In general, the villagers' only experience has been in collecting and managing a fund for a specific objective, usually a short-term activity, when the need has arisen; whereas, village-managed maintenance is a systematic long-term activity. A permanent fund with a sufficient and constant availability of cash must be maintained in order to quickly repair the system, purchase spare parts, and pay for the repairmen's services.

When asked how they would organize the collection of their maintenance fund, several villagers replied that they would collect the money only at the moment of a water supply system breakdown. The reason was they they did not have sufficient trust in anyone in the village to keep the large amounts of cash involved in a maintenance fund over a long-term period. If a village did not have an organized maintenance fund, and only collected money at the time of the breakdown, given the seasonal availability of cash, the villagers would not have cash on hand if the breakdown were to occur at any time other than the harvest.

While these villagers did not wish to entrust the maintenance fund to a community member, they did have confidence in the church missions and would be willing to entrust their maintenance fund to a responsible person at the Methodist or Catholic church mission located near their village. Some Catholic missions have carried out informal savings arrangements in the past for employees and others.

Villagers also pointed out during the survey that in the past some of the traditional chiefs had considered the AIDR-installed pumps as their personal property and had taxed villagers if they used the pump. However, the chief did not always use this money for repairing the pumps. Villagers expressed the fear that if they got a new water supply system, they would have to pay into two funds: one for the chiefs or other local authorities for using the system and the other to a village maintenance fund. Thus, the total amount would exceed their revenue potential. The result would be that they might not be able to afford to repair the water installation.

3.6.6 Community Organization Structures and Organization Capacity

In the majority of the villages (18 or 90 percent) there is a traditional leadership structure composed of a chief and his notables existing side by side with an MPR committee, a branch of the national political party, People's Movement for the Revolution. The MPR committees are generally composed of 7 to 12 community members, two-thirds men and one-third women, who are either appointed by the local government administration or elected by the villagers themselves by common consent. In two cases, however, the chief was president of the committee and had appointed members of his family to the committee. Heading the committee is an executive council made up of a president, secretary, treasurer, etc. The chief is sometimes a representative in this council. Depending on the size of the village, the committee also might have sub-committees: for youth, for political animation, propaganda, etc.

The role and function of the traditional leadership and MPR committee vary from village to village. In some cases the chief organizes the construction of a school or dispensary and in other villages the MPR Committee is responsible. However, as the MPR Committee is the local representative of the ruling party, all civil matters, matters of security, collection of taxes, or a village's obligatory contribution to the local administration come under its authority. Although it has some degree of autonomy in managing village affairs based on decisions made by the villagers themselves, the MPR Committee must also carry out those decisions originating from the centralized decision-making structure of the MPR party organ at the sub-regional and local administration levels. As already mentioned, in many villages both the chiefs and MPR committees have organized a collection of funds for various activities. In several villages the MPR Committee supervised a collective field, the proceeds of which were to be given to the local administration.

In addition to these structures, the larger villages also have several other professional associations, interest groups, and other village committees, such as a health committee, parent's education committee, church groups, and associations for artisans, fishermen, merchants, etc. When villagers were asked whether existing organizational structures could manage a communally-owned water supply and collect a maintenance fund, their replies varied

according to the manner in which their MPR Committee had been elected. In those villages where committee members had been elected by the villagers themselves, they usually named their MPR Committee as the group which could take responsibility for management and maintenance. In one village, where committee members were all political appointees, the villagers pointed out that committee members represented two rival political factions. They would never be able to carry out decisions that would be respected and followed by the entire village. As a result, the village said they would have to create a new committee to manage the water supply system.

Another important factor in assessing the organizational capacity for VLOM is the community's developmental history and past self-help experience. The indicators used to assess this variable were the village's self-help efforts and initiatives taken in constructing its primary school, dispensary, or health post. The villagers' contributions were collecting local materials, making baked bricks, and providing voluntary labor for construction. Twelve of the villages or 60 percent had initiated this type of self-help effort, and one village had contributed baked bricks and manpower to assist in the construction of a school in a nearby village. The number of villages with no self-help experience was small.

A community's cohesiveness, homogeneity, and ability to reach a consensus are also important in determining whether it will have the capacity to manage a collectively-owned property -- in this case making decisions about user fees and enacting regulations which will be respected by all users. While many of the villages, particularly the larger ones, were heterogeneous in terms of ethnic groups and religion, one ethnic group, Lunda or Tshokwe, was usually in the majority. There did not appear to be any conflicts because of these differences.

The spatial distribution patterns of a community are also important in assessing its capacity for management and maintenance. Reaching a consensus over the site(s) of water installations, for boreholes and public standposts, is more difficult when the village is dispersed. Users who are located farther away from the improved water supply may refuse to contribute to its maintenance, if they do not feel the system serves their water supply needs. This problem could arise in the village which is composed of a main center and a hamlet. It is doubtful that the people in the hamlet would be willing to contribute to the maintenance costs of a handpump located three kilometers away. The same problem can arise in larger villages composed of several neighborhoods. Usually people are willing to contribute to the maintenance of a water supply system only if it directly benefits them. In a village of 2,000 inhabitants made up of five to six neighborhoods, a borehole with a handpump could be sited in each neighborhood. In this case, each neighborhood should have its own water committee.

Internal conflicts were observed, however, in three of the small villages during the village meeting conducted as part of the survey. In one case, the chief and the other men in the community differed as to whether or not they would be willing to provide long-term management and financial support for handpump maintenance. In another instance, the women preferred a well with a handpump because of its convenience, while the men did not wish to pay the high O&M costs for a pump and thus preferred a spring catchment system. Neither of the villages had any self-help experience.

All of the villages in the survey had at least five members who were literate in either French, Lunda, or Tshokwe. While several of the men in each village spoke Swahili, the majority of women did not appear to understand Swahili or French well enough to be able to participate in a village extension meeting carried out in these languages. As women play the main role in water collection, it is essential that they are able to participate.

The team asked various people at the Catholic and Methodist missions whether water supply was important enough to the people in the sub-region for them to participate in construction and organize and raise funds for O&M. Several members of the church who had a long experience in the area underlined the need for village contributions in terms of materials, manpower, and especially cash. They felt that if the villagers did not contribute they would not feel that O&M was their responsibility and would not have a feeling of ownership of the systems. In the past, the missions and other organizations had given assistance to villages without involving the beneficiaries or expecting any contributions from them. This created a sense of dependency on the part of the villagers who expected "others" from the outside to help them, without taking any initiative to help themselves.

3.6.7 Technical Resources and Logistical Support Base

Four additional prerequisites for a VLOM system are a technically-oriented person at the village level who could be trained to be the caretaker; a skilled craftsman within a reasonable distance from the village, who could be trained to be repairman; a dispensary or religious mission to be used as a spare parts distribution outlet, located at a reasonable distance from the village; and a bicycle so that a villager can alert the repairmen in the event of a breakdown or travel to the spare part outlet to purchase the necessary spare parts. Sixteen or 80 percent of the villages had a technically-oriented person in the village who could serve as water supply caretaker, while in 95 percent of the cases there was a bicycle repairman located with 20 kilometers of the village. Eighty percent of the villages had a bicycle at their disposal and 90 percent were located within 40 kilometers of a religious mission or a dispensary which could serve as the spare parts outlet.

3.6.8 Summary conclusions of the Village Survey

In assessing the villages' potential for long-term support for VLOM, a distinction must be made between the management and maintenance requirements for a piped distribution system or handpump and those for a spring catchment system. Seventy percent of the villages were found to have the prerequisites for village level management and maintenance for a handpump or piped distribution system. Two of the remaining six villages preferred a spring catchment system, as they did not feel they would be able to support the annual O&M costs of a handpump. Four villages in the survey were assessed to have a low capacity for VLOM for a handpump, two because of insufficient financial resources and two because of low financial resources, internal conflicts, and organizational difficulties. (See Table 1.)

TABLE 1: ASSESSMENT OF VILLAGES' SOCIO-ECONOMIC POTENTIAL FOR VLOM

Indicators / Village	Less than 250 inhabitants	Low level of literacy	Lack of Primary School	No dispensary in village or w/in 20 km	No mission in village or w/in 20 km	No community organization in village	No self-help experience	Internal Conflicts/ Organizational difficulties	Lack of financial resources to pay for maint (15Z per hshld/mo)	No tech-oriented person in village to be caretaker	No bike repairman w/in 20 km of village	No means of transport at village disposal	No spare parts outlet w/in 40 km from village	Low potential for VLOM	VILLAGE CHOICE OF WATER SUPPLY SYSTEM: Spring Catchment	Pump	Piped distributi
1. MWISHAMWARA (682 inhabitants)																0	
2. TSHIKOMA (450)			I				I								0	0	
3. MBAKU (1400)																	
4. LUMBIMBO (200)	I		I	I	I		I	I	I					I	0		0
5. NEOMBO																	
6. KATEMB (250)																0	0
7. KAMAMFUMBA (200)	I		I				I		I	I				I	0		
8. TSHAMBA (1150)					I											0	
9. PANDAMWELA (900)					I											0	
10. RUTSHATSHA (250)				I	I											0	
11. MWENEIMBU (40)	I		I	I		I	I	I	I	I				I			
12. DILOLOFOSTE (2000)																	0
13. MUTEYE (3327)																0	
14. KATENDE (100)	I			I	I					I		I	I	I		0	
15. SANGAJI (275)			I			I										0	
16. KAHUNDU (1250)																0	
17. KALIPA (200)	I		I	I	I		I	I	I		I	I	I	I		0	
18. TSHIBAMBA (420)																0	
19. TSHANIKA (1800)																0	
20. SHINDE (300)			I				I	I		I		I		I			

Legend: I indicates negative potential for VLOM
0 indicates village choice of water supply system

3.7 Human Resource Development

3.7.1 Human Resource Requirements

The human resource requirements for a VLOM system are:

- An effective community organization capable of village level management and maintenance of the water supply system.
- The availability of one or more qualified caretakers at the village level.
- The availability of skilled and equipped repairmen.
- Qualified community development extension workers.
- Qualified health educators.

3.7.2 A Community Organization

At the community or village level, an effective community organization is necessary which can serve as the water committee. This committee must assume responsibility for all management tasks, collect and manage a maintenance fund, and ensure the operation and maintenance of the water supply system. It should be elected by the users themselves and should represent all the users of the water supply system. As this committee manages a collectively-owned property and makes decisions on its use and the contributions expected from the users in terms of labor, materials, and cash, it is essential that all of the committee members hold the respect and confidence of the entire community.

While the number of members on the committee is a decision of the community, it is recommended that it contain a core group of officers (president, secretary, treasurer) one or two womens' representatives, and one or two caretakers. The president will be responsible for conducting village meetings and coordinating all village activities. The secretary should be literate as he or she will be responsible for reporting all committee decisions and in the event that the treasurer and caretaker(s) are illiterate for carrying out the bookkeeping for the maintenance fund and keeping records of all water supply system repairs. The treasurer, who will have the responsibility of keeping the maintenance fund, must have the trust of the community. A checks and balance system is created between the treasurer (or secretary) and the other committee members, for while one holds the fund, the others verify the bookkeeping and amounts. The women are responsible for organizing the village women to clean the area around the water point and all the drainage canals and other water facilities. The caretakers are responsible for all preventive maintenance tasks.

The core group of officers will be responsible for the overall water supply system management:

- Arranging for and supervising a community's contribution of local materials (sand, rock, gravel, and in some cases, baked bricks),

voluntary labor for site preparation, preparation of an access road to site, and workcrews to assist SNHR brigades during construction.

- Selection of site(s) for water supply installations(s).
- Selection of candidates for repairmen (applicable to wells/handpumps and piped distribution systems).
- Determination of community financing system for maintenance (in villages with handpumps and piped distribution systems this includes collection and management of a maintenance fund to purchase supplies, tools, and spare parts to pay for repairs).
- Establishing and enforcing guidelines and rules for use of water installation.
- Implementing user and health education.
- Supervising caretakers' preventive maintenance tasks and purchase of tools and supplies.
- Monitoring and protecting against abuse of the system.
- Resolving conflicts over use of the system.
- Keeping records and reports.
- Notifying repairmen in case of routine repairs or back-up maintenance service in case of uncommon repairs and purchasing necessary spare parts (in villages with a handpump or piped distribution system).

Both the handpumps and piped distribution systems demand greater management capacities of the water committee than spring catchments, particularly with respect to collecting and managing a maintenance fund, contracting for a repairman, and purchasing the necessary spare parts.

Each of the planned piped distribution systems will affect a large number of villages, neighborhoods, and institutions. Therefore, the user organization will be more complex and require better technical and financial management. Before systems are installed, the project management team and the beneficiary communities should decide whether or not to install water meters and whether to use public (standpost) or private connections. These decisions will determine whether rates will be based on actual usage or average water consumption per household. If water meters are installed, it will be necessary for the water committee to read the water meters on a monthly or quarterly basis. The committee should have a detailed plan of the entire water supply system, so the pipe and valve sizes are known if replacement of a leaking section is necessary.

In addition, the committee will have to decide whether it wishes to contract repairmen or sub-contract the repair services to a church mechanic.

The village survey revealed (see Section 3.6) that the majority of villages visited have an organizational structure; however, not all of these meet the above-mentioned criteria for a water committee because their members may not be representative of the water supply users or they may not have been selected by the user community. During the community organization phase of the extension work, it may be necessary to adapt existing community organizations to meet the requirements of a water committee. In some cases a new committee will have to be created.

While many of the organizations had experience in collecting a fund, they need training to manage a maintenance fund. Moreover extension work and training will be necessary to strengthen the community's management capacities.

3.7.3 Caretakers Tasks

Caretakers' maintenance tasks are outlined in Sections 3.3.2 - 3.3.6.

While the O&M tasks for a spring catchment system are relatively simple, it is essential for the continued functioning of the system that the drainage and diversion canal are cleared regularly and that the spring box is maintained in order to provide good quality water in sufficient quantities.

The day-to-day operation of piped distribution systems needs careful supervision by a caretaker to ensure that users will have equal access to water. A simple broken tap in one place can drain away a large part of the available water at the expense of all other users. Daily inspection of all water distribution points is necessary for private connections and public standposts so that problems can be corrected immediately. The entire system should be checked for leaks once a week.

The field survey revealed that technically-oriented persons (bicycle repairmen, masons, and blacksmiths) are available at the village level (see Section 3.6). These persons will need to be trained in the skills necessary and equipped with the proper tools and supplies to carry out the preventive maintenance tasks.

3.7.4 Repairmen's Tasks

Repairmen's tasks are outlined in Sections 3.3.5 and 3.3.6.

The caretaker or another member of the committee should notify the repairmen in the event of a pump breakdown. To avoid a monopoly situation and to ensure a means of recourse to a village if it is not satisfied with the services provided or prices charged by a repairman, every village should have repair services available within a 20 to 40 kilometer radius of the village. It is estimated that the services of 100 qualified repairmen will be needed to repair the 500 pumps, once they are all installed.

In the case of the piped water distribution systems (seven in total), two to three qualified repairmen per system will be necessary. In the event of a pump-assisted piped water distribution system, one of the repairmen should have some mechanical training.

It was found that bicycle repairmen are the only category of artisans sufficiently represented all over the sub-region with skills somewhat comparable to those needed for the repair of water supply systems. Sixteen artisans were interviewed; 15 were bicycle repairmen, while one was a gunsmith. Three of them had experience repairing motorcycles and engines. Four repairmen (25 percent) had studied mechanics in a technical school, while 12 (75 percent) had learned mechanics in an apprenticeship situation or from experience repairing their own personal bicycle.

The artisans served from one to about 15 clients per week. Only three artisans (19 percent) appeared to be occupied full-time repairing bicycles.

About half the repairmen usually purchase the necessary spare parts for the clients, while the other half request the clients to buy their own parts.

All the repairmen had the following tools: an adjustable wrench, multiple bicycle wrenches, some open wrenches, a hammer, and a screw-driver. Fifty percent of the repairmen, mostly those in the larger towns, also had pliers, a file, one or more socket wrenches, and vise-grip pliers.

Three repairmen had experience in plumbing, while two older artisans remembered having worked on old FBI pumps with AIDR maintenance crews.

Thirteen (81 percent) of those interviewed had their own bicycle, the remaining three (19 percent) did not have any means of transportation. All would be willing to travel to repair pumps. The acceptable travel range quoted varied from 20 to 100 kilometers, for an average of 57 kilometers.

Fifty percent of the artisans stated literacy in French; 56 percent in Lunda, 62 percent in Tshokwe, and 75 percent in Swahili.

All artisans interviewed showed interest in participating in pump repair or piped distribution systems training, although two had certain conditions. Only 25 percent of the artisans stated they would be capable of purchasing additional tools with cash. The other 75 percent stated they would require credit arrangements.

3.7.5 Extension/Training Unit

Qualified community development extension workers will be necessary to carry out an initial series of five to six meetings in every project village (estimated at 700 to 800 villages) to assist communities in participating fully in the choice, construction management, and maintenance of their improved water supplies. The extension workers will also carry out follow-up visits at six month intervals once the systems are installed in order to monitor and assist the communities and water committees with any problems they might have in management tasks (e.g., collection and bookkeeping of maintenance fund) or in the operation and maintenance of the water installations. (Refer to Annex G for more detailed description of extension workers' tasks.) Following the initial series of village extension meetings, the extension unit will train the water committee members (some 4,000 committee members, including the caretakers). They will also assist the SNHR pump and piped distribution system brigades in the training of the repairmen.

In order to carry out these tasks, the extension workers should have experience in community development work in rural areas, a technical understanding of the project's rural water supply systems, community participation and community development skills, training skills, and a basic understanding of water and sanitation in relation to health education. Moreover, the extension workers should be proficient in the local languages, Lunda or Tshokwe, as well as in French and Swahili.

An extension unit chief will be necessary to supervise and coordinate the activities of the extension unit. He will be responsible for developing, coordinating, and supervising community development extension programs and organizing training activities.

While the final project agreements identified the need for two extension workers, only one had arrived at the time of this consultancy. The initial effectiveness of this extension worker will be hampered by his lack of previous experience with water supply activities and the fact that he speaks none of the local languages in the area. Moreover, his proficiency in Swahili is not adequate to carry out village extension work. Given the fast pace at which the project proposes to install water supply systems and the need for VLOM, the extension training unit must be upgraded and additional extension workers must be recruited and trained to carry out their tasks. In addition, an extension unit chief will need to be recruited.

3.7.6 User Education Activities

The installation of an improved water supply system is not itself sufficient to ensure that the village will appreciate the benefits of the new system over the existing, traditional water supplies. If there is an insufficient appreciation of the value of the new system, it will not be maintained and used properly. Villages must be motivated to change their behavior with regard to water. O&M system development should therefore not be geared to equipment maintenance only but should also include related actions such as environmental sanitation around water points and correct water use at home. While these measures should be incorporated into the O&M-related training and extension work, a sustained program of water-and-sanitation-related user education should also be carried out in the villages before and after the installation of the water system. This would assist the water committees in developing and implementing a user education activity for other groups in the community.

Extension workers will have a limited amount of time to carry out user education activities during the village extension work and training activities. In light of their intensive schedul they will not be able to return to villages on a regular basis.

The field survey revealed that there are mobile health education brigades based at the government hospitals and health personnel at the health centers and dispensaries who are not able to go out to the villages to carry out health education because they lack transportation. Currently, the nurses at the dispensaries carry out health education at the dispensary once a month, but it usually pertains to maternal child care and nutrition.

Existing health personnel at local dispensaries in the area expressed an interest in carrying out water and sanitation related user education in the project villages; however, they lack participatory skills, visual aids related to water and sanitation, and bicycles. In addition, the Médecin-Chef in the area also expressed a willingness to collaborate with the project.

To date the SANRU I project has provided bicycles and some health education training (mainly maternal child care) to health personnel in the Kapanga area. To participate in this project, they would also need additional user education training related to water and sanitation and visual aids. SANRU II has made no commitments as yet to provide assistance to any of the four rural health zones in the sub-region.

The main emphasis of the Shaba Refugee Health Project is on rebuilding and equipping a number of medical facilities. While it does support some public health activities, this support is not extended on a consistent basis throughout the four rural health zones. As the project is designed now, it would not be able to provide back-up support to all existing health personnel in the sub-region in the form of training, or provide them with bicycles and visual aids.

3.7.7 Human Resource Development Logistics

An initial assessment was made regarding the need for and availability of training facilities that could be used by project staff for short-term training in the sub-region.

Training water committee members in villages where only a spring catchment is constructed would be fairly simple; there are few requirements. Training could be conducted by an extension worker in the village itself, and no lodging or feeding arrangements for the participants would have to be made.

Training requirements for committee members in villages where a pump would be installed would be more complicated. Workshops for committee members are expected to take several days. From discussions with government representatives it was concluded that the most efficient system would be to bring together committee members from five to eight villages in a larger village (e.g., the chef-lieu of a groupement or a collectivite) where training could be conducted in a primary school and where lodging and feeding arrangements could be made with local residents. At present, similar arrangement are used for administrative and political meetings and seminars. Transport of participants by project vehicles would be required.

Water committees in towns and villages where a piped water distribution system is to be installed are likely to be larger and more complex. The training of the members of such committees could be conducted in a school in the principal town to be served by the system. In most cases only feeding arrangements would be required.

Repairman training will be the longest and most complicated, as a well and a workshop will be required in addition to a classroom, boarding and feeding facilities, and transport. Discussions with the missions revealed that classroom and boarding facilities would be available only during the three

school vacations. Government schools do not have boarding facilities. Given the limited number of repairmen to be trained (25 per year) it would be possible to schedule their initial training during these vacations. The project staff would have to select one or two training centers per zone and make arrangements with the staff of the institute. Only in the Methodist missions in Mwajinga and Kasaji could both lodging and feeding the trainees be subcontracted to the mission (at a cost of approximately 100Z per day per trainee).

The staff of the technical school in Mwajinga was found to be interested in participating in pump repair training workshops. This should be followed up by project staff. Also to be followed up is the possibility of including handpump repair in the first year curriculum of the technical school, since at least part of the students remain in Lualaba Sub-Region upon graduation.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 Description of the Proposed O&M System

A three tier O&M system in the Lualaba Sub-Region based as much as possible on existing structures and services is proposed.

4.1.1. Community Level

It is recommended that the beneficiary population as the users, should have ownership of the water points. As owners, they will be expected to participate in construction and installation and maintenance and will be responsible for paying all recurrent maintenance costs. All decisions regarding the choice of the type of water supply facility and its siting should be taken jointly by beneficiary population and the technical and extension work teams, taking into account technical, economic, social, and cultural factors as well as the village's financial capacity to pay for the maintenance of the water system in question.

AIDR, SNHR, and AID jointly should develop a protocol defining the exact contribution to be made by the beneficiaries for each type of planned water installation.

The beneficiary populations should elect a water committee which will be responsible for the management and maintenance of their water installation(s). The members of the water committee should be trained by the extension training team of the project.

A written agreement should be drawn up for each water supply system which is to be signed by AIDR, SNHR, and the beneficiary population. This agreement will set forth each party's responsibilities regarding its contributions in terms of labor, equipment, and materials needed for the construction and the operation, maintenance, and management of the installation. As proof of the villages or communities' commitment, its water committee should establish a maintenance fund and collect an amount equal to the recurrent maintenance costs for the first year. The committee should also purchase the supplies and tools for the caretaker. These should be made pre-conditions before construction can begin.

The village should select a caretaker who will be trained by the project to carry out minor preventive maintenance tasks, ensure that the area around the water point is kept clean, and arrange for repairmen visits. It is assumed that this would be a voluntary position. The caretaker will be a member of the water committee. The project should supply tools and supplies for village caretakers at cost from their maintenance fund to be paid for prior to construction by the village water committee.

Since the beneficiary populations are expected to cover the costs for O&M of the installations, SNHR should take steps to legally prohibit all local authorities from levying additional taxes on water supply installations.

4.1.2 Repairmen Level

Field surveys have shown that bicycle repairmen are the only qualified craftsmen that exist in sufficient numbers in the sub-region to ensure the repair of pumps at a reasonable cost, provided they receive the necessary training. The beneficiary population and a project representative should jointly select approximately 100 craftsmen to be trained by the project's pump installation unit in collaboration with the extension/training unit. After an initial training, the pump repairmen should assist the pump installation unit with the installation of five pumps in neighboring villages.

A similar selection and training process should be developed for water distribution system maintenance personnel (two or three artisans per system).

Tool kits purchased by the project should either be sold or provided on credit to all repairmen, and proceeds and repayments should be deposited in the revolving spare part fund of a designated mission or church station closest to the repairmen's home village.

All repairmen will be contracted and paid by the communities for specific repair jobs, if and when needed.

4.1.3 Spare Parts Distribution and Back-up Services

According to the population, most government representatives in the area, and non-governmental organizations, a self-sustaining spare part distribution system would best be managed by the Catholic and/or Methodist churches. The representatives of both churches in the area have expressed their interest and willingness in managing such a system on the following conditions:

- that their respective bishops concur in their involvement,
- that the project provide an initial stock of spare parts to serve as a revolving fund, and
- that Cooperation Belge act as a procurement agent for spare parts (this would involve ordering parts in Kinshasa, arranging transport to and storage in Lubumbashi; agreement in principle has been reached).

SNHR and AIDR should enter into discussions with church representatives at the local and diocese levels and with Cooperation Belge to finalize the organizational and financial framework for a spare part distribution system. An initial stock of spare parts sufficient for 18 months should be purchased with project funds and donated to the church mission/station at district/parish level. All responsibilities should be outlined in a memorandum of understanding, signed by AIDR, SNHR, and the respective church mission/station.

SNHR and AIDR should negotiate a supply and service contract with the pump supplier which should include the following:

- a guaranty clause for all pumps,

- inspection and certification of all pumps prior to shipment from India by the same independent engineering firm that provides these services to UNICEF,

- a guaranty of availability of spare parts in Zaire at an import company representing the pump supplier for a minimum period of five years, and

- a month TDY by a pump expert to Zaire to train project and SNHR mechanics in pump installation and O&M procedures.

Given the availability of plumbing supplies in Lubumbashi, it is not deemed necessary for the project to establish a formal parts distribution system for piped water distribution systems. Instead, the project should help identify spare part needs and supply lines during the training of water committee members for these systems. Furthermore, the project should provide these committees with a one-year supply of parts at cost, to be paid from their O&M funds.

In the case of renewable-energy-powered pumping systems the project staff should identify a church mission/station which could assume the responsibility for ordering spare parts abroad for the system's water committee.

In order to provide back-up repair services to the pump repairmen in the case of nonroutine pump problems, the project should identify three church-based garages with qualified mechanics. More specialized training and equipment should be provided to these technicians for this purpose. As long as the SNHR station has a pump installation unit it could provide the same services. It is proposed that the complete pump installation tool kit, a tripod, and a winch be provided to each of the church-based garages which have a qualified mechanic in each of the three zones, and to the SNHR station in Sandoa.

As there are no banks in Lualaba Sub-Region and the only existing savings arrangements are limited to accounts for employees and others at some of the Catholic missions, the project manager and the chief of the extension training unit in the three zones should discuss with the Catholic and Methodist missions setting up of mission-managed savings accounts for the deposit of the maintenance funds of the respective village water committees. Those missions which will be part of the spare parts distribution system, selling the spare parts and managing the revolving spare parts funds, could also manage the villages' savings deposit fund if a village so desires. This arrangement would limit the need for villagers to handle cash once their savings deposits are made. The mission can simply deduct the cost of the spare parts purchased from the village's appropriate savings fund, and disburse small amounts to the village to pay for the repairman's labor costs.

4.2 Training and Extension Needs Assessment for Establishing a VLOM System

It has been estimated that for the project to have a reasonable chance of success the following software inputs are needed:

- 6,000 village extension meetings (initiation and follow-up) carried out by the community development/extension workers.

- Management, operation, and maintenance training for 4,000 village water committee members (training to be conducted by community development extension team).

- Training in pump repair and piped water distribution operation and maintenance for 120 local craftsmen and mission repair teams for back-up services, carried out jointly by the responsible SNHR technical brigades and the extension/training unit.

- Establishment of an adequate training/extension unit, recruitment and training of its staff in water supply and sanitation, community development and training methodology.

- Training of technical SNHR brigades in training village caretakers, repairmen and mission repair teams.

4.2.1 Community Level

The village water committee members' training will be of five days duration in total consisting of an initial three-day training workshop, followed at a later date by a two-day refresher course.

The initial training will be three days in duration in which all the committee members will receive the following training: system management procedures for collecting and managing a maintenance fund; simple bookkeeping methods, the correct operation and use of the water supply system; recordkeeping procedures for recording repairs and spare parts replaced; water related environmental health education with regards to ensuring environmental sanitation measures around the water point; correct water use; as well as conflict resolution and problem solving methods. During this three-day training, the caretakers will also be trained to carry out their preventive maintenance tasks. A member of the various SNHR brigades will assist in carrying out this technical training for the caretakers.

A follow-up refresher training of two days duration will be carried out approximately eight to twelve months after the improved water supplies have been installed for the water committee members.

4.2.2 Repairman Level

The training of pump repairmen will be of ten days duration in total, consisting of an initial six day workshop.

The training of pump repairmen will take place in three stages. Initially the repairmen will participate in a six-day workshop during which the following topics will be covered:

- use of tools
- problem diagnosis

- analyze and practice routine repairs, including lifting, dismantling, repairing, and installing pumprods, pistons, cup leathers, and sealing rings and foot valves.

This initial training would be followed by several days on-the-job training assisting the pump installation brigade in installing no less than five pumps in the villages where the repairmen are expected to service pumps.

After 12 to 18 months the repairmen would participate in a four-day refresher course, the curriculum of which will depend on weaknesses detected by the project staff.

For mission-based repair teams providing back-up services, supplementary training would be provided for non-routine repairs during an extended workshop and by providing on-the-job training during the installation of at least ten pumps near the collaborating mission.

The piped water distribution system repairmen's training would consist of a short workshop addressing the use of tools, the operations of the system, and practice of routine repairs and preventive maintenance (daily, weekly, monthly, etc.)

Furthermore, these repairmen would participate in the installation of the entire water supply system in their community during which they will receive intensive on-the-job training from SNHR technical brigades over a period of several months.

4.2.3 Training of Trainers

Adequate training will need to be provided to the extension workers and trainers of the extension/training unit and the members of the technical SNHR brigades responsible for handpump installation and piped water distribution systems, so they in turn can provide training for the project participants at the village level.

The training needs for the extension/training unit are addressed in section 4.3. The technical brigades will require training in both technical issues and training methodology. The first can be provided by long-term AIDR staff and a consultancy by a representative from the supplier of the India Mark II handpump, as part of the pump supply and service contract. The training methodology component should be provided by the chief of the extension/training unit after he has participated in the training of trainers workshop for the extension/training unit.

4.3 Community Development Extension/Training Unit

The extension training unit should be established and/or upgraded. This unit should consist of one chief and six community development extension workers. Equipment, housing, and means of transportation (one four-wheel vehicle and four additional motorcycles) should be provided by the project.

4.3.1 Recruitment and Training of Extension Unit

So as not to slow down project implementation, it will be necessary to recruit an extension unit/training chief in December 1985, immediately followed by recruitment of sufficient candidates to allow for the selection of four additional extension workers with local language skills hired and paid by the project. (Selection and final approval of candidates will be a joint decision made by SNHR/AIDR.)

The chief of the extension/training unit should be hired for the first three years of the project (commencing in December 1985) and, based on the findings of the mid-term evaluation, one of the six community development extension workers should assume the position of chief of unit for the last two years of the project.

The candidate extension workers should be trained in January and February 1986, together with the two extension workers selected by SNHR, in community development/extension work techniques, specifically geared toward rural water supply. The training will also include community participation techniques, technical and O&M aspects of all water supply systems, community diagnosis skills, problem solving, and conflict resolution methods, as well as water and environmental sanitation-related health education.

It is proposed to schedule a follow-on training of trainers workshop for the extension workers in April and May 1986, covering experiential adult learning method techniques; the training of water committee members in operation, maintenance, management, and accounting techniques; user/health education, business management (for repairmen) and training methodology. This workshop should be conducted by an experienced trainer of trainers, either from WASH or the SANRU project.

4.4 Project Support Activities

4.4.1 Promotional Support Activities

There is a lack of information and, in some cases, even false information about the project on the part of the local population, government services, and the churches (missions). As a result it will be necessary to organize a series of meetings at various sub-regional administrative levels in order to explain and discuss the project's objectives, planned installations, and methodology.

4.4.2 Health Education Activities

For the beneficiaries to accept, maintain, and use the installation properly, they need a sustained program of effective user education carried out in the villages before and after the installation of the improved water supplies. Since the project does not have the personnel to implement this component, an attempt should be made to collaborate with the existing health structures and health projects in Lualaba Sub-Region's four rural health zones: SANRU II and the Shaba Refugee Health Project.

The health personnel of the health centers, dispensaries and health posts in the project zones lack specific health education training, health educational materials related to water and sanitation, and the means of transportation (bicycle) to do health education extension work in the villages. (Kapanga Zone would need only health education materials relating to water.) It is therefore recommended that USAID designate one of the health projects to provide the necessary back-up support to the water project and then supply personnel with health education training, water and sanitation related visual aids, and bicycles.

4.4.3 Education/Information Support Materials

Various training aids, manuals, and visual aids should be prepared by the project to be used during the information/educational extension and training activities being planned. These materials should include:

- A series of posters depicting each of the types of improved water supply systems: a spring catchment, a borehole equipped with an India Mark II handpump, pump apron, drainage canal and animal drinking trough with enclosure wall, and a piped water distribution system with public standposts and taps.

- User education materials which include flipcharts and posters depicting the following themes:
  - the transmission cycle of water-related diseases,
  - water and hygiene, and
  - cleanliness around the water point.

- A manual for village water committee members which covers basic health education concepts, the responsibilities and tasks of committee members, examples of bookkeeping and recordkeeping procedures for the village maintenance fund, preventive maintenance tasks of village caretakers, and examples of recordkeeping procedures for recording water supply system repairs and the spare parts replaced.

- O&M and repair manuals for the various water supply systems suitable for use by pump repairmen, church mechanics from the maintenance back-up service, and the project pump installation brigade.

4.4.4 Integration of Extension Workers into Rural Health Zones

In the event that SANRU II implements its primary health program in all the four rural health zones of Lualaba Sub-Region (at present Kapanga is the only zone covered by SANRU I, and Sandoa, Dilolo, and Kisenge health zones not included under SANRU II), the four community development extension workers hired by the project should be integrated into the four SANRU rural health zones upon completion of the water supply project. They should perform the role of rural water coordinators.

4.5 Project Budget

The initial project budget did not include any provisions for the procurement of spare parts for any water supply systems or tools for village caretakers and repairmen. Furthermore the cost of the India Mark II pump had been underestimated. A revised budget for pump and tool procurement was prepared (see Annex F). The estimated cost is $399,188.

While initially virtually no training or extension activities had been planned, the project budget did include a significant amount for these purposes. Therefore, only a 10 to 20 percent increase of the training and extension line items will be necessary to accommodate the vastly expanded functions of the project's training/extension unit (see Annex F). The project manager should revise the 1986 detailed budget accordingly.

4.6 Project Selection and Allocation Criteria

The demographic reality and existing hydrological situation rule out following the project paper's initial proposal of installing two to three water points in each village. The project should develop criteria for the selection of villages which are to receive improved water supplies and develop allocation criteria as to the number and types of water installations.

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ANNEX A

List of Persons Contacted

USAID/Kinshasa	Henry Lee Braddock, Director, DEO Office Tim Born, Project Officer Kate Newman, Project Officer Felix Awangtang, Health Office
USAID/Lubumbashi	Skip Waskin, Project Officer Cit. Ishmael Mukengela, Adjoint Chef of Shaba Refugee Health Project
U.S. Consulate/ Lubumbashi	Karl Danga, Consulate General
AIDR	Guy Petit, Director Maurice DeBachere, Project Manager, Shaba Refugee Water Supply Project
SNHK	Cit. Sowa Lukono, Director
SANRU	Dr. Franklin Baer, Director (Adjoint) Cit. Itoko Yoluke, Responsable Eau et Assainissement
Peace Corps	Tom Wayman, Associate Peace Corps Director/Agriculture Rural Development Ruth Deer, Associate Peace Corps Director/Water
UNICEF	Mr. Vandeberghe, Representative
Tata Exports Ltd.	R.L. Das, Manager (Representative of Manufacturer of India Mark II Pump)
Cooperation Belge/ Lubumbashi	Raymond de Block, Logistics Coordinator
UNHCR	Cit. Rgigi, Controlleur de Base Jean Dion, Geohydrologist Celestin Des Jardin, Community Development Mr. Vits, Agronomist
Cooperative Agricole de Kapanga	Dieter Imhoff, Manager
Catholic Diocese of Kolwezi	Bishop Songa Songa
Catholic Mission of Sandoa	Father Joseph Father Paulus Father Francois Brother Alphonse
Catholic Mission at Ntita	Father Govaers Father Jacques

Catholic Mission at Kasaji-Lueo	Father Michael
Methodist Mission at Musumba	Dr. Pauline Chambers, Acting Medecin Chef of Kapanga Director of Samuteb Memorial Hospital Geraldine Allen, R.N., Director of Chisambu Medical Technical Institute
Methodist Mission of Mwajinga	Cit. Sulnaweg
Methodist Mission of Kasaji	Cit. Momo
Commissaire de Zone Assistant of Sandoa	Cit. Mashako Mamba Sembi
Commissaire de Zone Assistant of Kapanga	
Commissaire de Zone Assistant of Dilolo	Cit. Kitango Bondo Mwla
Colonel du Brigade de Sandoa	
Colonel du Brigade de Kapanga	
Colonel du Brigade de Dilolo	Col. Bahindwa
Commandant de l'Infanterie du Brigade de Dilolo	Maj. Bukasa
Mwant Yav de Musumba	
Chef de Collectivite de Matshisenga (Sandoa)	
Chef de Collectivite de Tshisengama (Kasaji)	
Chef de Collectivite de Tshipawo (Sandoa)	
Medecin Chef of Sandoa	
Medecin Chef of Dilolo	Cit. Muhemeri Bizibu
Regideso	Chef de Station de Dilolo, Cit. Kamba
Inspecteur du Service de l'Agriculture et Developpement Rural de zone de Sandoa	Cit. Luseba
Inspecteur du Service	Cit. Lusabala Manema

de l'Agriculture et
Developpement Rural de
Zone de Dilolo

Training Institutes Visited:

Lubumbashi	Institut Superieur du Developpement Rural
Mwajinga	Institut Dias (Agricultural/Technical Training School)

Hospitals, Medical Centers, and Dispensaries Visited:

Sandoa Zone	Sandoa Government Hospital Sandoa Leprosarium Dispensary Kafakumba-Kimpuki Medical Center Kafakumba Lac Dispensary Mwajinga Dispensary Matshisenga-Samatoma Dispensary
Kapanga Zone	Samuteb Memorial Hospital Chisambu Medical Technical Institute (Nursing and Public Health Training) Kateng Health Post
Dilolo Zone	Dilolo Gare Government Hospital Dilolo Poste Medical Center Kasaji - Chisengama Hospital Kasaji - Lueo Medical Center Katoka Medical Center Kazembe Dispensary Kisenge Dispensary

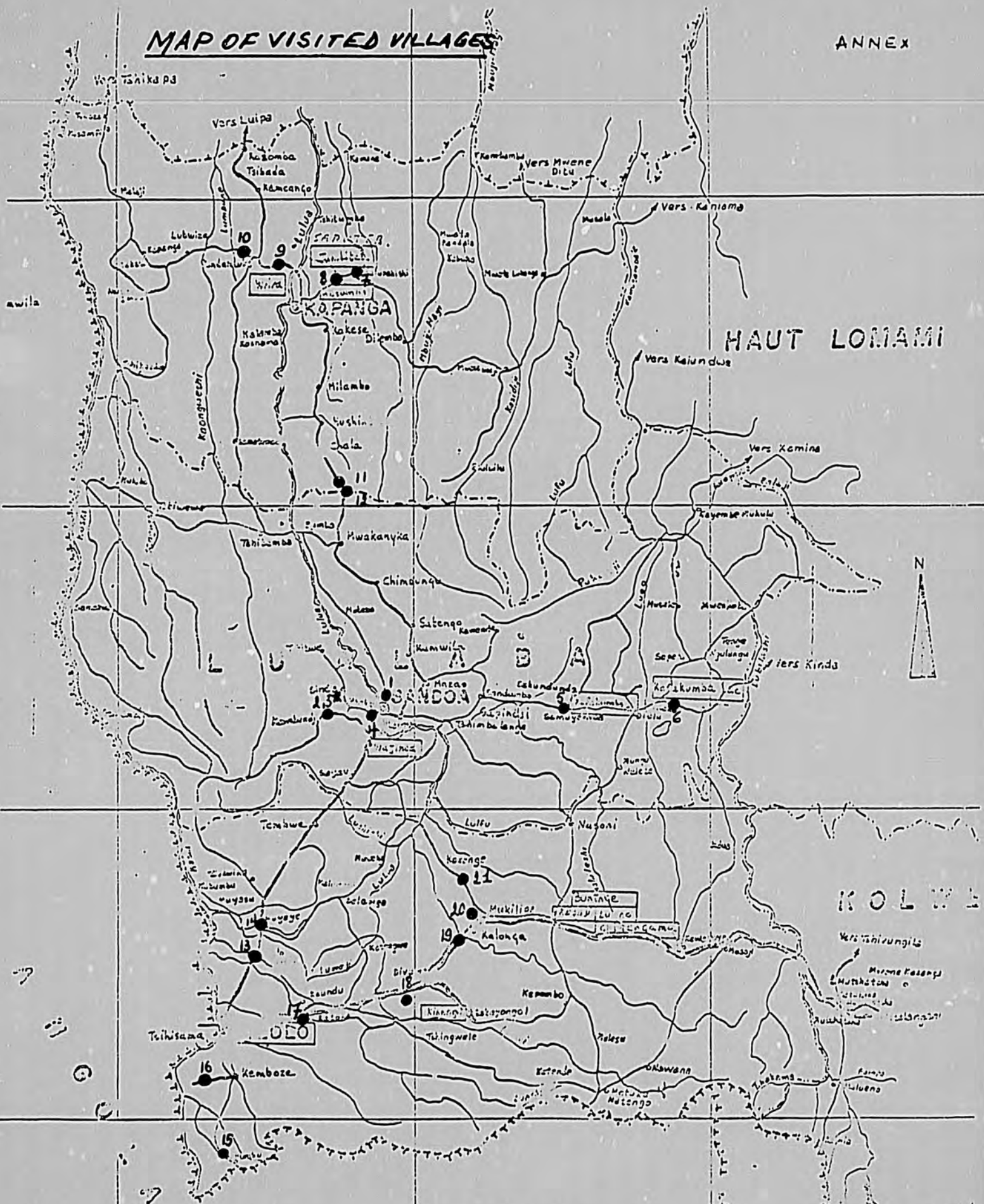
ANNEX B

Village Survey

(List of villages surveyed,
map of area, questionnaire used)

MAP OF VISITED VILLAGES

ANNEX



These number refer to the list of villages found on following page in annex.

* Numbers 2 and 3 comprise one village

List of Villages Visited During Socio-Economic Survey

Zone	NR	Village	Population
Sandoa	1	Mwishamwaka	682
	2	Tshikoma	450
		Kanika (1)	50
	3	Mbaku	1,400
	4	Lumbimbo	+ 200 *
	5	Ngongo	+1,000
Kapanga	6	Kateng	250
	7	Kanampumba	200
	8	Tshamba	+1,150
	9	Pandamwela	900
	10	Rutshatsha	250
	11	Mwene Imbu	40
	12	Dilolo Poste	+2,000
Dilolo	13	Muyeye	3,327
	14	Katende	+ 100
	15	Sangaji	278
	16	Kahundu	+1,250
	17	Kalipa	+ 200
	18	Tshibamba	420
	19	Tshanika	1,800
	20	Shinde	300

(1) Kanika is a hamlet of Tshikoma

* +200 = greater than 200

VILLAGE SOCIO-ECONOMIC SURVEY QUESTIONNAIRE

No._____

Name of Village: _____ Administrative Zone:_____
Collectivite: _____
Groupement: _____

Date of Survey _____ Participants at Village Meeting:

Men _____
Women _____
Children _____

Village Leadership Present _____

Population:

What is the population of the village?

No. of Inhabitants _____ Source of Data _____

What are the village's characteristics in terms of:

Principal ethnic groups? _____
Principal religious groups? _____
Principal languages? _____
Migration and Mobility of the population? _____

What are the migration and mobility patterns?
Is there: For each, how much?

Temporary emigration? _____ _____

Permanent emigration? _____ _____

Temporary arrival of new groups? _____ _____

Permanent immigration? _____ _____

Tendencies of village?

Population increase__ decrease__ no change__

If there is a population increase, which factors have influenced it and may have an influence on the number of potential water supply users in the village?

Security _____ Means of subsistence _____ Fertile land _____
Village services/and infrastructure _____ Water _____ Other _____

What is the level of literacy in the village in the following languages?

	French		Lunda		Tshokwe		Swahili	
less than 5 persons literate (<5)	more than 5 persons literate (>5)		<5	>5	<5	>5	<5	>5

Settlement Patterns:

What are the settlement patterns of village grouped?

Number of neighborhoods?_____

What is the percentage of houses constructed of of adobe brick? _____

of houses constructed of baked brick? _____

Straw roof? %_____

Tin roof?% _____

Village Infrastructure/Services

What are the infrastructure/ services found in the village?	If not in village, at what distance from village in Km's are they located?
Health Post, Dispensary _____	_____
Primary School _____	_____
Secondary School _____	_____
Market_____	_____
Merchants_____	_____
Religious Mission_____	_____

What are the village water resources and what are their uses?

Water point	During rainy season	Uses	During dry season	Uses	Distance for Villagers
Modern:					
Borehole/Pump					
Cemented Well					
Traditional:					
Well/Handdug					
Water Hole					
Surface River (River, Stream)					
Groundwater- Natural spring					

Are there any water problems in terms of quantity or

reliability at the end of dry season? Yes___ No___

What is the estimated water quality? Good ___ mediocre___ poor___

Modern: Borehole/
Pump, Cemented well

Are any of the following water-related illnesses prevalent in the village?

Guinea Worm __ Schistosomiasis __ Diarrhea_____

Organizational Structure

How is the village organized? What is the traditional leadership structure?

Are there any village committees? Yes_____ No _____ If so, what type?_____

Composition? _____

Function? _____

Does the village carry out collective work activities? Yes_____ No_____

Is there a tradition of self-help activities? Yes___ No___ If so, what type?

Is there a tradition of collecting money? Yes___ No___ If so, purpose, amount?

Is there a treasurer? Yes___ NO___ If so, whom? _____

Which government services are carrying out extension work or outreach programs in village? _____

Which PVO activities are carried out in village?_____

Technical and Logistical Resource Base

Indicate if the following exist in the village or at a reasonable distance?

Artisans/ Craftsmen	In Village	Distance
Craftsmen		
Blacksmith	_____	_____
Bicycle Repairmen	_____	_____
Motorcycle Repairmen	_____	_____
Mason	_____	_____
Carpenter	_____	_____

What means of village transportation exist?

Vehicle _____ Motorcycle ------ Bicycle _____ Cart _____

Animal _____

Economic Revenue Base

What are the major sources of revenue for the village?	Estimated Amount	Seasonal Variation
Collective Field _____	_____	_____
Agricultural Cooperative_____	_____	_____
Salaried Employees_____	_____	_____
Artisans _____	_____	_____
Cash Crops_____	_____	_____
Game/Fishing _____	_____	_____
Livestock _____	_____	_____
Other _____	_____	_____

Subsistence Agricultural Crops _____

Are there any costs for drawing water? Yes___ No___ If so, what are they?____Z

What is the village preference for type of improved water supply system?

Spring Catchment _____ Borehole/Pump _____ Rehabilitated Well/ Pump _____

Piped Water distribution system _____

What is the estimated financial capacity per household to pay for maintenance costs? _____Z

What is the village choice for additional facilities?

Laundry facilities _____ Animal drinking trough _____

ANNEX C

Artisan Survey
(List of artisans interviewed,
map of area, and questionnaire used)

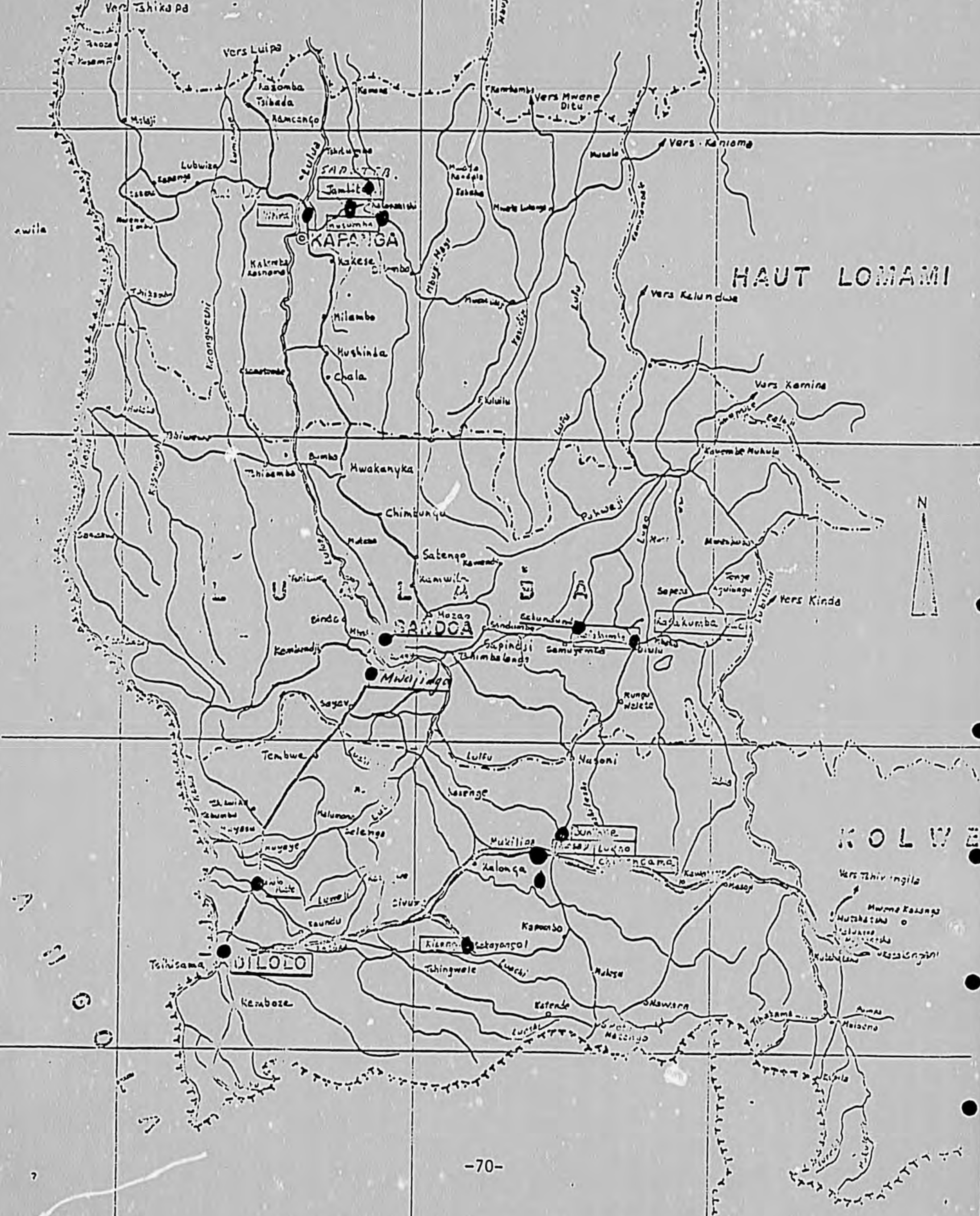
Artisans Interviewed	Village/Town	Zone
1. Cit. Tshilonda K.	Sandoa	Sandoa
2. Cit. Kambol Tshinges	Sandoa	Sandoa
3. Cit. Jawa Jambo	Sankandundo	Sandoa
4. Cit. Kapenda Bukasa	Kafakumba Poste	Sandoa
5. Cit. Kakone Mwabhenu	Kafakumba Poste	Sandoa
6. Cit. Mwutushila Hijika	Kafakumba Poste	Sandoa
7. Cit. Mwujunda	Kapopo	Kapanga
8. Cit. Tshikompe T.	Kanampumbo	Kapanga
9. Cit. Mbaz Kahan	Mambeka	Kapanga
10. Cit. Kabadioum	Musumba	Kapanga
11. Cit. Nawa Muchanga	Dilolo Poste	Dilolo
12. Cit. Lueno Kaneja	Dilolo Gare	Dilolo
13. Cit. Kaoko Malenge	Kisenge	Dilolo
14. Cit. Mujumba Ch.	Kisenge	Dilolo
15. Cit. Mbaza	Kazembe	Dilolo
16. Cit. Tshosa N.	Tshijeso	Dilolo

Questionnaire:

1. Name:_____
2. Age_____
3. What kind of work are you involved in?
4. How many years have you done (bicycle) repair work?
5. Where/From whom did you learn this work?
6. Who are your customers? Where do they come from? How many a week?
7. If spare parts are needed, who gets/buys them? The customer or the repairman?
8. Can you show me all of your tools so I can make a list of them?
9. Now I would like to ask you about the amount you charge your customers for various repairs. How much do you charge for:
   - repairing a leak in an inner tube?
   - spoking a wheel?
   - various small repairs on one bike that take one day to complete?
   - mounting an entire bicycle from the original parts brought to you from the city by a customer? (have you done this before?)
10. Have you ever participated in repairing an old F.B.I. pump?
11. Have you ever done any plumbing work?
12. If the project organized pump repair training, and a village nearby requested that you participate, would you be interested in joining the training for 2 weeks, somewhere in the area?
13. You have a fair/limited number of tools, sufficient to perform bicycle repairs. However, in order to repair handpumps you would require additional tools. Would you be interested in buying those tools? Do you have sufficient income to afford such tools? If not, would you be interested in credit arrangements?
14. What means of transport do you possess? mobylette/bicycle/on foot
15. If a pump breaks down in a village at 20 km distance would you be willing to go out there and repair it? Up to what distance would you be willing to go? ____km. If you do not have a bicycle, would you require that village to provide you with one? (e.g., rented).
16. What languages do you speak and understand well? What languages do you read and write well?

ARTISANS/BICYCLE REPAIRMEN VISITED.

ANNEX



ANNEX D

Church Mission Survey
(List of missions visited,
map of area, questionnaire used)

Catholic and Methodist Missions visited:

Catholic Mission Sandoa; Fathers Joseph, Pualus, Francois; Brother Alphonse
" " Ntita; Fathers Govaers, Jacques
" " Dilolo Poste; Father Pancras
" " Kasaji-Lueo; Father Michel
Methodist Mission; Geraldine Allen, Pauline Chambers
" " Mwajinga; Executive committee
" " Kasaji; Cit. Momo

1. Do you think water supply is important enough to the people in this area for them to participate in construction and organize and raise funds for O&M of a water supply system? Yes/No

2. Would a contractual agreement between the implementing agencies and the villagers outlining each party's responsibilities with regard to construction and O&M be useful? Yes/No

3. Do villages have the technical aptitude to perform O&M duties if some training is provided by the project? Yes/No To what degree?

4. What would be the best channel for the distribution of spare parts? Government of Zaire/Shops/Missions

5. Would your mission be willing and able to support the distribution of spare parts - a) with Mission investment in the initial stock; b) with an initial stock provided by the project

6. Does your mission have an outreach network in the villages? Yes/No
max. distance _____ km
no. of villages _____

7. Does your mission have an informal savings program which could be used for the deposit of village O&M funds? Yes/No. If not, would you be willing to set up such a program?

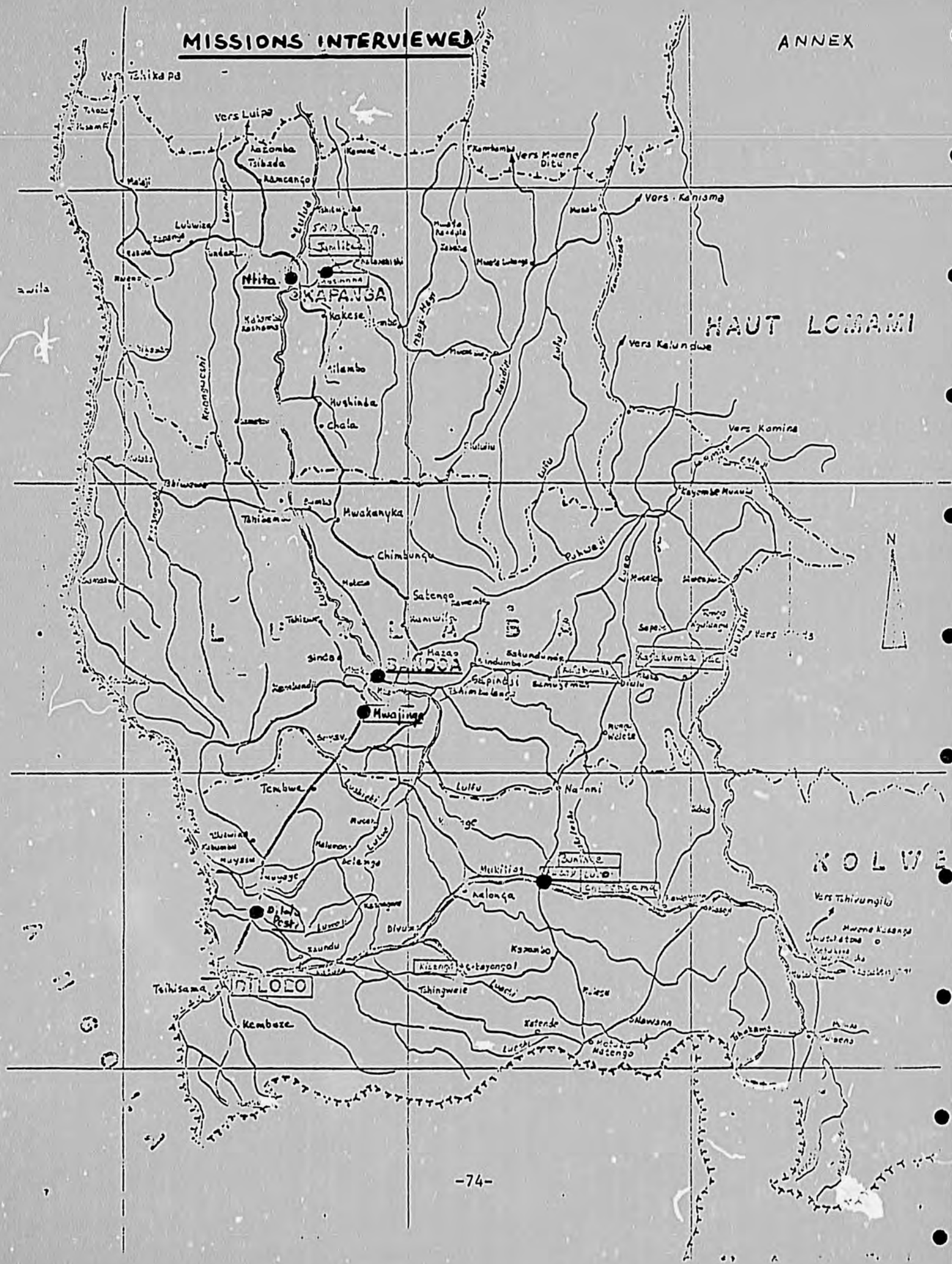
8. Would your mission be willing to participate in organizing training sessions? Yes/No; Is training space available? Yes/No; Could lodging and feeding arrangements be made? Yes/No. Costs per day:_____Z

9. If your mission forms part of a larger gravity-flow water supply system what role could your mission play in system O&M? What kind of management organization would be most suitable?

10. Are there any special or political constraints to O&M that we have not discussed?

ANNEX

MISSIONS INTERVIEWED



ANNEX E

Shops Survey
(List of shops surveyed,
map of area, questionnaire used)

List of Shops Visited:

1. Musumba: Vamaz Commercial
2. Musumba: Ets. Petit Paradis
3. Musumba: Ets. Supermarche
4. Sandoa: Quincaillerie Beyaluka
5. Sandoa: Ets Rufino
6. Sandoa: Ets Kalukuta
7. Dilolo Poste: Ets Matenda Kapen
8. Dilolo Poste: Ets Nicos
9. Dilolo Gare: Ets Nicos
10. Dilolo Gare: Ets Kpaend Tshipofoy
11. Kisenge: Ets Rufino
12. Kasaji: Ets Rufino
13. Kasaji: Ets Kabwebo

Questionnaire:

1. Name of the shop:_____Manager's name Cit./M._____

2. Proprietor's name and background_____

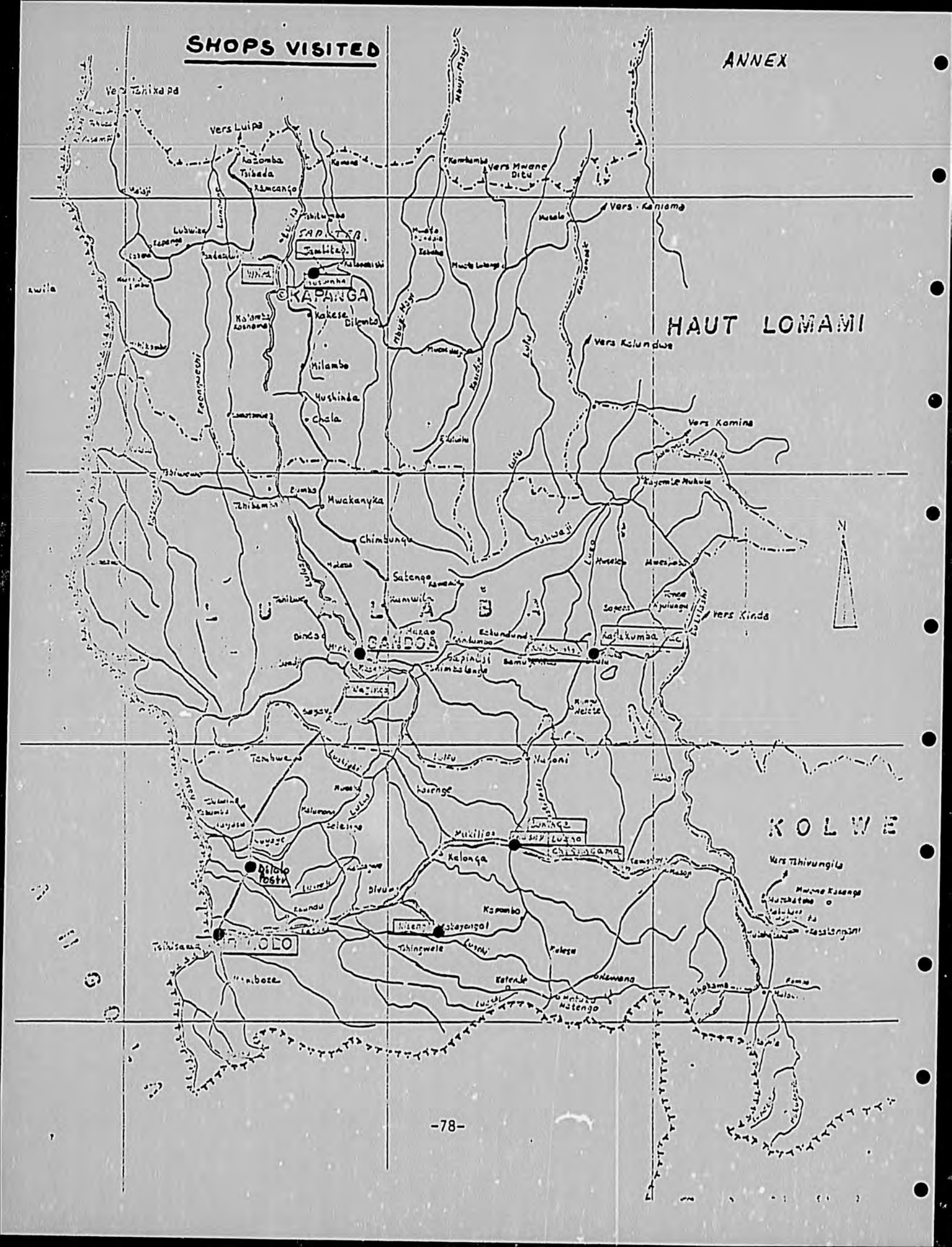
3. What kind of merchandise do you carry? Any bicycle spare parts?

4. What are the retail prices of: Inner tube _____Z
   Spoke _____Z
   Pedal set _____Z
   Saddle _____Z

5. Where do you procure your merchandise from; How is it transported to your shop; How often?

6. Would you be interested in procuring and selling spare parts for handpumps once they are installed in villages in the Lualaba Sub-Region?

In Lubumbashi wholesale prices for the items listed under question 4 were checked at several wholesale outlets, mentioned by shopkeepers as the source of their merchandise.


SHOPS VISITED
ANNEX
Vers Luiza
Kazomba
Tshibeda
Kamcanço
Vers Mwene Ditu
Vers Kaniama
Lubwika
Tshibumba
SADITA
Tshikapa
Kasomba
KAPANGA
Kakese
Dilenda
HAUT LOMAMI
Vers Kalundwe
Milambo
Mushinda
Chala
Vers Komina
Mwakanyika
Chimbunga
Satenge
LUBA
Vers Kinda
Kapakumba
GANDOA
Dilolo Poste
Kalonga
Vers Tshivungila
KOLWE
Kasenga
Kapemba
Katoyenga
DILOLO
Tshingwele
Katende
Okemeng
Tshama
Mutuzu Katengo

ANNEX F

Financial Calculations

Financial Calculations

1. Costs of INDIA MARK II Pump Spare Parts

Following is a list of spare parts for the INDIA MARK II handpump, the quantities required for five years (as recommended by TATA Exports), the total C.I.F. Matadi costs of these parts in US $, the suggested retail price for these parts in the Lualaba Sub-Region and the anticipated costs to the user communities for five years.

No.	Spare Part Name	Qty.	Amount ($) CIF/Matadi	Retail* price(Z)	Total for 5 years(Z)
01	Hex. bolt M12x1.75x40mm	16	6.40	50	800
02	Hex. nut M12x1.75	32	3.80	15	480
03	Washer 4mm thick	4	1.00	35	140
04	High tensile bolt M12x1.5x490	3	1.90	80	240
05	Nyloc nut M10x1.5	5	3.20	80	400
06	Handle axle, stainless steel	1	12.00	1,500	1,500
07	Bearing (6204-2Z)	6	47.80	1,000	6,000
08	Chain with coupling	3	35.90	1,500	4,500
09	Bolt for front cover	2	0.70	45	90
10	Rubber washer	10	23.80	300	3,000
11	Leather sealing ring	18	17.20	120	2,160
12	Rubber seating (big)	5	2.40	60	300
13	Rubber seating (small)	5	2.40	60	300
14	Rubber O-ring	5	2.40	60	300
15	Upper valve guide	2	3.80	250	500
16	Upper valve seat	2	2.60	170	340
17	Upper check valve guide w/retainer	1	7.20	900	900
18	Connecting rod	4	28.70	900	3,600
19	Hex. coupling	2	9.60		1,200
	Total for one pump for 5 years		$212.80		26,750
	or per year:		$42.56	(=2341Z)	5,350

*Based on the following increases: 75% for import duty, transport Matadi-Kinshasa and importer profit over CIF Matadi; 8.78% transport to Kasaji via Lubumbashi over importer price; and 20% mark-up by missions over Kasaji price for overhead and risk. If private traders were to be responsible, the mark-up would be approximately 46% over Lubumbashi prices and the total costs per year per pump would be 6,376Z (1.75x1.066x1.46x2,341Z).

2. Major Spare Parts for INDIA MARK II Pumps

It is anticipated that after the fifth year of operation the following major spare parts will need to be replaced occasionally:

No.	Spare Parts Years 6-25	UNIT PRICES Qty.	Amount ($)* CIF/Matadi	Retail ** Price (sugg.)
01	Cylinder body w/sleeve	1	71.74	5,200Z
02	Top cap	1	5.58	400Z
03	Bottom cap	1	3.98	300Z
04	Water chamber	1	31.87	2,300Z
05	Handle assembly	2	55.80	4,100Z
06	Head assembly	1	111.60	8,000Z
07	Stand assembly	1	71.70	5,200Z
08	Check valve assembly	1	51.80	3,700Z
09	Plunger assembly	1	47.82	3,500Z
10	Plunger rod	2	7.18	600Z
11	Riser pipe	12	19.98	1,500Z
	Total for years 6-25			56,000Z
	or per year			2,800Z

*if ordered separately from TATA Exports

**It is approximately 40% cheaper to order complete pumps and to dismantle those in Zaire for major parts. The retail prices of major pump parts have been calculated based on $505.-CIF Matadi for one pump and 100% overhead for import duty, profit, transport, and risk. This is a lower percentage as with the minor parts, but given the costs of these major parts, the absolute profit will still be reasonable.

3. O&M Cost Calculations for Piped Water Distribution Systems

The following calculations are based on the estimated construction costs for the Kasaji and Sandoa/Mwajinga water supply systems in Lualaba Sub-Region (Estimates prepared by AIDR, September 1985.)

Kasaji: Micro-hydro assisted pumping system and gravity flow
Population: 15,090; Households: 2,156 (7 persons each)

Available flow: 615 m^3/day or 225,430m^3/year
Estimated costs: 13,150,000Z (AIDR, 1985)
Assumed invoiced flow: 150,285 m^3/year (67%)
Assumed annual O&M costs: 263,000Z (2% of investment costs)
Annual O&M per volume: 1.75 Z/m^3
Annual O&M if invoiced by household: 122Z

Sandoa/Mwajinga: Entirely gravity flow; Available flow: 153,080 m^3/year
Population: 11,800; households: 1,686 (7 persons/household)
Estimated costs: 8,000,000Z (AIDR, 1985)
Assumed invoiced flow: 102,564m^3/year (67%)
Assumed annual O&M costs: 80,000Z (1% of investment costs)
Annual O&M costs by volume: 0.78 Z/m^3
Annual O&M costs if invoiced by household: 61Z

4. Project Budget

Certain project budget modifications will be necessary to allow implementation of the proposed O&M system. Additional expenses will be incurred under the following line items: - 7. Bore-hole wells; 9. Piped water distribution systems; 12. Training; and 13. Extension.

4.1 Pump Procurement (line item 7)

Originally no budget provisions had been made for spare parts, spare pumps or tools for village caretakers and repairmen. Furthermore the costs of the pumps had been grossly underestimated. It is assumed here that because of the envisaged increase in piped water distribution system coverage the total number of pumps will be reduced from 570 to 500 and that the pumps will be ordered in two shipments.

Ordering Information (all costs in US $, CIF Matadi):

Item	Initial Order (250 pumps) Qty.	Unit price	Total	Project Total Qty.	Amount
Pump, INDIA MARK II (VLOM)	250	505.00	126,250.00	500	252,500.00
Additional pumprods*	500	7.18	3,590.00	1,000	7,180.00
Additional riser pipes*	500	19.98	9,990.00	1,000	19,980.00
SUBTOTAL PUMPS:			139,830.00		279,660.00
Spare parts:					
Additional pumps (to be dismantled for major spare parts)	12	505.00	6,060.00	24	12,120.00
hex.bolts M12x1.75x40mm	1,200	0.40	480.00	2,400	960.00
hex.nuts M12x1.75	2,400	0.12	285.00	4,800	570.00
washer 4mm thick	300	0.25	75.00	600	150.00
high tensile bolt, M12x1.5x490mm	225	0.63	142.50	450	285.00
nyloc nut M10x1.5	375	0.64	240.00	750	480.00
handle axle stainless steel	75	12.00	900.00	150	1,800.00
bearing (6204-2Z)	450	7.97	3,585.00	900	7,170.00
chain w/coupling	225	11.97	2,692.50	450	5,385.00
bolt for front cover	150	0.35	52.50	300	105.00
rubber washer	750	2.38	1,785.00	1,500	3,570.00
leather sealing ring	1,350	0.96	1,290.00	2,700	2,580.00
rubber seating (big)	375	0.48	180.00	750	360.00
rubber seating (small)	375	0.48	180.00	750	360.00
rubber O-ring	375	0.48	180.00	750	360.00
upper valve guide	150	1.90	285.00	300	570.00
upper valve seat	150	1.30	195.00	300	390.00
upper check valve guide w/retainer	75	7.20	540.00	150	1,080.00
connecting rod (pumprod)	300	7.18	2,152.50	600	4,305.00
hex. coupling	150	4.80	720.00	300	1,440.00
SUBTOTAL SPARE PARTS:			22,020.00		44,040.00

Tools:**

District workshop tool kit	5	570.00	2,850.00	6	3,420.00
Stilson wrench 17x19 (crank sp)	350	NA	NA	700	NA
wire brush	350	NA	NA	700	NA
coupling spanner	50	NA	NA	100	NA
handle axle punch	50	NA	NA	100	NA
connecting rod holding device	50	NA	NA	100	NA
connecting rod lifter	50	NA	NA	100	NA
chain coupling supporting tool	50	NA	NA	100	NA
rebar hook w/rope	50	NA	NA	100	NA
tripod and winch	5	NA	NA	5	NA
tool kit for piped water distr. system	10	125.00	1,250.00	20	2,500.00
ESTIMATED SUBTOTAL TOOLS:			15,350.00		23,420.00
Customs clearance, storage, transport to Sandoa by project truck, 15%			26,580.00		52,068.00
ESTIMATED GRAND TOTAL			203,780.00		399,188.00

*based on estimated depth of cylinder of 36 meters below the surface; it is possible that the quantity of pumprods and riser pipes can be reduced for the second shipment, depending on borehole drilling experience during the initial year of the project.

**based on 2 district workshop tool kits plus two tripods and two winches for the AIDR/SNHR pump installation unit and one such set of tools and equipment for three mission garages. The sixth tool kit is a replacement for SNHR. Tripod and winch estimated at $500. per set.

Included are tools for village caretakers as outlined in 3.3.5. As these tools and supplies will be paid for by the village water committees (identical in case of piped water distribution systems) only $2,500 has been budgeted for the project as a revolving fund for these inputs.

Included are tool kits for 100 pump repairmen as outlined in 3.3.5 at an estimated cost of $125 per tool kit, and 20 tool kits for piped water distribution system repairmen, also at $125.

4.2 Training and Extension (line items 12 and 13)

Personnel:

4 additional extension workers @ 6,500Z/month x 54 months	1,404,000Z
per diem and bonus for 2 planned extension workers @ 3,500Z/m	378,000Z
1 Training/Extension chief @$3,500 /month x 36 months (paid in local currency)	6,930,000Z
Per diem Lubumbashi for chief (during 3 years)	337,500Z

Travel:

Air travel 6.5 return tickets Kin-Lshi	170,000Z
1 Landrover Pick-up	800,000Z

8 additional motorcycles (replaced in year 3)	720,000Z
Spare parts for all vehicles	760,000Z
Fuel for all vehicles	1,170,000Z
Camping equipment	35,000Z
Housing	
1 house, fully equipped and furnished	970,000Z
Training:	
Committee members per diem, 4000 x 6 days x 100Z/day	2,400,000Z
Repairmen, 120 x 10 days x 100Z/day	120,000Z
Training materials*	1,000,000Z
Recruitment, training of extension workers (local costs)	100,000Z
TOTAL TRAINING AND EXTENSION (excl technical training)	17,294,500Z
or	$ 314,445

Previously budgeted $123,000 (Training) + $192,000 (Extension) of which $34,500 has been committed for technical training.

*Training materials include all educational materials and health education visual aids and posters used to train extension workers; all visual aids, posters, and manuals used during village extension and work and sub-regional information meetings as well as for the training of villager water committee members; and all manuals used to train repairmen, caretakers, and specialized repair backup service units. IT DOES NOT INCLUDE, HOWEVER, THE COST OF HEALTH EDUCATIONAL MATERIALS AND VISUAL AIDS FOR THE IN-FIELD HEALTH PERSONNEL, NURSES, AND HEALTH AGENTS, IN THE EVENT THEY WILL CARRY OUT HEALTH EDUCATION IN VILLAGES WITH AN IMPROVED WATER SUPPLY SYSTEM.

**This budget does not include a provision to cover the costs of training the in-field health personnel in health education techniques or for equipping them with bicycles.

ANNEX G

Plan of Action for Implementation
of Extension Work and Training Activities

One of the major problems in the way improved rural water supply systems have been installed in the past in this area is that wells and pumps were installed in villages without informing, consulting, nor involving the beneficiary users in the planning or construction of these water supplies. Moreover, although it was assumed that the users would maintain and repair the supplies, no provision was made to prepare, organize or train the villagers to acquire the skills and knowledge they would need to manage and maintain the pumps. No provision was made to train repairmen or to provide for a spare parts distribution system.

This led the majority of the villagers to consider the water points not as their own but as property of the state. Not being directly involved in all the decisions leading up tc the creation of the improved supplies created an attitude of passivity and disinterest on the part of the intended beneficiaries. Two to three years after the pumps were installed the majority had broken down and remained broken down.

The present water supply project is based on village level operation and maintenance. The users will take responsibility for the water supply systems and manage and maintain them. This project attempts to correct the errors committed in the past by installing appropriate hardware — VLOM systems which can be managed and maintained by the system's users, and by providing trained repairmen and a spare parts distribution system. While all of these are essential to the success of a VLOM system, the most important task facing the project will be to create conditions in which the users feel a sense of responsibility and ownership of their water supplies and have both the willingness and capacity to provide long-term support for their management and maintenance.

The project's objective is to achieve maximum community participation. The means to achieve this end must also be based on a strategy of maximum community participation in all phases leading up to the creation of the water supplies. Effective community involvement in all phases of the planning and construction of the water supplies will be a key factor to ensure that the communities effectively value, use, manage, and maintain the supplies once they are installed.

The strategy of the community development extension work is based on permitting maximum community involvement and participation, as well as providing community organization, education, and training for the water committee members, including the caretaker, so that they can carry out their tasks. During the training workshop for the extension workers, the participants will develop strategies to

- assist communities to decide whether or not to participate in the project and to select the most appropriate and feasible improved water supply system,

- develop appropriate community organization structures to supervise the community's participation in construction and be responsible for management and maintenance, including the collection and management of a maintenance fund for the water supply system,

- assist communities to prepare for and participate in the construction of the selected water supply system(s), and

- aid communities to formulate and practice user guidelines for operation and maintenance of the improved water supplies.

TASKS/ACTIVITIES OF EXTENSION WORKERS

Pre-planning and Assessment Phase

Pre-entry

1. Collect and analyze information about the villages and towns in the project areas/zone.

   - Verify population size -- number of inhabitants of each village. (Demographic data is available at administrative collectivity level.)

   - Collect general information as to demographic movements and trends that could have an influence on the number of potential users per water point (arrival of Angolian refugees, or returning Zairians).

   - Inventory available local craftsman -- bicycle repairmen who could be trained to be pump repairmen or repairmen for gravity piped (or pump-assisted) distribution systems. Collect information as to technical skills, level; experience; literacy -- oral, reading, writing proficiency in vernacular language; amounts charged for various repairs, means of transportation; interest in being trained to become water supply repairmen.

2. Meet with local government and other officials, representatives of government services (Health, Social Affairs, Agriculture and Rural Development), non-governmental organizations, and of religious missions, and zonal representative for the spare parts outlet in each zone and collectivity (the various sub-regional administrative levels):

   - Present information about project, its objectives, types of water supply installations, and methodology. Discuss criteria used to select villages.

   - Present provisional list of villages which are to be offered assistance in improving their water supply. Present O&M system and spare parts distribution system and the communities/villages role in the VLOM system.

   - Discuss written agreement engagement to be signed between users and SNHR. The users will have ownership of the water installations and will assume responsibility for the management and maintenance of the improved supplies. Present action plan/calendar of activities/construction schedule for villages.

   - Discuss need for support activities from in-field health personnel to carry out water/hygiene related health education in villages to receive an improved water supply.

3. Meet with in-field health personnel at zone and collectivity administrative levels to plan coordination of health education activities to be carried out by nurses and health agents in the project villages before, during, and after installation of improved water supplies.

Entry into Villages/Communities

4a. Meet with local leadership of village. Explain water supply project. Determine if village is interested in participating. Arrange for next meeting.

4b. Conduct meeting with entire village. Explain objectives of water supply project, types of water supply installations, and project methodology. Explain role of extension worker. Explain relationship of water to health (chain of water-related diseases), and the benefits of safe and accessible drinking water.

5. Discuss, assess, and identify (together with the villagers), the village's problems with regards to water quality, reliability, quantity, accessibility, and convenience. Discuss current water use and practices pattern. Determine if modern wells or pumps exist in village. Discuss reasons for use/non-use, past dry periods. If pump is not functioning, discuss past history of maintenance and repair. Determine existing water supply sources and demand in terms of number of users and number of improved installations necessary to meet demand. Determine spatial distribution of users and likely user patterns.

6. Find out if improvement of community water supply is a felt need and a community priority.

7. Identify and explain the choice of improved water supply systems that are technically and economically feasible (with respect to the project's allocation criteria) to improve the village/community's water supply. Explain the construction, functioning, and operation and maintenance of each type of installation.

8. Explain the responsibilities of the project and those of the community/village with regard to each type of water supply system in planning, construction, installation, operation and maintenance, system management, and financing maintenance.

   - Establishment of a water committee which will be responsible for water supply system maintenance and management. Collection and management of a maintenance fund (except for villages which will have a spring catchment system).

   - Selection of a caretaker to carry out periodic preventive maintenance tasks.

   - Selection of several candidates to be repairman.

   - Purchase of supplies and tools for caretaker.

- Provision of local materials and manpower for site preparation and construction.

- Village commitment to accept ownership of water installations and assume responsibility for management and maintenance (written agreement signed with SNHR).

9. Assess (together with community) the available resources (human, technical, financial), the community's capacity and willingness to manage, and maintain various types of water supply systems (with regard to population size, leadership/organizational capacity, financial revenue base, presence of literate community members to compose water committee), and the availability of a technically oriented person in the village to be caretaker. Assess the necessary infrastructural/logistical supports to community (distance to spare parts outlet, means of transportation at village disposal, availability of repairman within reasonable distance).

   This assessment will assist the extension worker to guide the villagers in making an informed decision as to the most appropriate water supply installation(s) in light of their human, technical, material, and financial resources, capacities, and logistical support base.

10. At a subsequent meeting, discuss and arrive at a decision with the community/village re: commitment of village to receive an improved water supply, and choice of an installation(s).

Planning and Design Phase

11. Assist in organizing a water committee (creation of a new committee or adapting an already existing one to meet criteria for a water committee). (See Section 3.7.2 for more detail.)

12. Discuss and arrive at decision with water committee re:

    - commitment of village resources to program and acceptance of ownership of water supply system and accompanying management and maintenance

    - determination of community financing system for maintenance: collection and establishment of a maintenance fund to pay for all recurrent maintenance costs, including purchase of supplies and tools for preventive maintenance, repairman's labor charges for repairs, and spare parts. Maintenance fund must be established before construction can begin. In villages for which spring catchment systems are being constructed, no organized maintenance fund is necessary.

    - determination of roles/responsibilities before, during, and after installation

    - selection of a caretaker

    - arrangements for voluntary labor for site preparation and construction and for provision of local materials

    - determination of guidelines and rules for use of water installation(s)

- selection of site(s) of water supply installation(s) (e.g., borehole(s)/pumps or public standpost(s)). This decision will be based on the various options for siting proposed by project geohydrologist to water committee

- selection of additional water facilities (animal drinking trough, laundry facilities to be constructed).

Develop (together with committee members) a work plan for collecting local materials prior to construction and organizing workcrews of voluntary manpower to assist in construction and installation.

Construction Phase

13. Verify if village commitments have been fulfilled so that construction can begin. Exact protocol of community/village contributions is to be determined by AID/AIDR/SNHR. However these could be:

    - establishment of a water committee
    - signing of written agreement
    - collection of maintenance fund (with the exception of villages with spring catchment systems)
    - selection of caretaker
    - purchase of supplies and tools for caretaker
    - collection of local materials
    - preparation of road and access to site (strengthening any bridges)
    - clearing vegetation, preparation of site
    - availability of workcrews of voluntary manpower to assist SNHR brigades during construction, installation.

Management, Operation and Maintenance Phase

14. Train water committee members (core groups of officers) in overall system management; financial management and accounting of VLOM maintenance fund; supervision of preventive maintenance, record keeping of maintenance and repairs of water supply installation(s), procurement of spare parts, arranging for intervention of repairmen or back-up maintenance unit; correct water supply system operation and use, procedures for protection from contamination of water supply installation and ensuring cleanliness around water point area; training caretakers in operation of system and preventive maintenance tasks.

15. Orient water committee to concept of clean water for health using improved water supplies. Develop and plan health and user education strategy with committee as to how committee members can introduce health concept and carry out demonstrations of clean water handling and storage techniques to village via public meetings and discussions with small target groups (women, men, children, primary and secondary schools). Demonstrate possible participatory communication techniques such as role playing, drama-play acting, use of visual aids.

16. Develop with caretaker a maintenance schedule.

17. Identify potential problems that may arise in the use of water supplies,

their operation and maintenance, the collection and management of maintenance fund (seasonal availability of cash), and procurement of spare parts, and develop strategies with water committee for use of water supply installations.

18. Coordinate with in-field health personnel nurses and health agents the dates and schedule for their health education interventions in selected villages.

Follow-up and Evaluation Phase

19. At periodic intervals (e.g., six month intervals) carry out follow-up visits to village after installation of water supplies to meet with committee members. Together with committee members, evaluate if water supply installation(s) and drainage systems are functioning correctly. Is the area around the water point clean? Are the installations being operated correctly. Are they being utilized as intended — for drinking water. Are the villagers using only the improved water supplies to collect drinking water or are they still continuing to use the traditional water sources? Discuss with committee if any benefits are being achieved from the improvement of the water supplies? Identify if committee members are encountering difficulties in carrying out management and maintenance tasks (e.g., procurement of spare parts; collection and management of maintenance fund; resolving internal conflicts among users; adjusting to seasonal availability of cash; enforcing rules for use of water supply installations; protecting and ensuring cleanliness around water point; seeing that preventive maintenance tasks are carried out by caretakers; checking bookkeeping, and recordkeeping of repairs and spare parts replaced, functioning of water supply installation and drainage system, cleanliness around water point, etc.).

20. Carry out refresher training of committee members and caretakers (8 to 12 months after installation of water supplies or in response to committee members' needs as revealed during periodic follow-up visits. Additional objective of refresher workshops will be to permit committee members to exchange experiences in managing VLOM systems.

Extension work activities will be carried during an initial cycle of village extension meetings lasting five to six weeks (with a week interval between meetings) in which the community will be given the opportunity to accept to participate in the project, assist in the selection of their water supply system(s), its siting, form a community organization (water committee), select a caretaker and candidates for repairmen, determine the procedures for collecting a maintenance fund, make preparations for site preparation and organize collection of local materials and manpower to assist SNHR brigades in construction. If possible, the project geohydrologist or an SNHR technician should visit the village during this technical initial five week period to determine what are the possibilities for borehole sites or public standposts. He will then inform the extension worker and the community water committee so that the extension worker can assist the committee or village in selecting from or, in the event there is only one siting option, accepting the proposed sites.

Before construction can commence, the extension worker will determine if the community's commitments have been fulfilled in terms of the existence of a water committee, selection of a caretaker, the collection of a maintenance fund equal to the first year's O&M costs, collection of local materials, preparation of access road, if necessary, site preparation and availability of sufficient manpower to assist SNHR brigades during construction, installation. It is at this point, once the community has followed the project's commitment, that the committee, in front of the entire village can sign a written engagement, which lists those responsibilities of the project/SNHR and those responsibilities of the community with respect to the water supply system(s) in question, concerning the management, operation and maintenance of the supplies as well as its responsibilities for ensuring sanitary conditions around the water point. The written engagement will formalize the community's ownership of the water installations and its acceptance of all accompanying responsibilities.

If at all possible, the extension worker should return to the village for a meeting after construction/installation of the water supplies in order to meet with village to discuss correct operation and use of the installations and develop maintenance guidelines. However, whether it will be feasible for the extension workers to return to the village immediately following the construction/installation will depend upon the timing as to how soon the construction/installation takes place after the initial extension work takes place, as well as the logistical considerations with respect to where the extension workers will be at the point in time.

If it will not be feasible for the extension worker to return to the village immediately following construction of the supplies, it will be necessary for the extension worker to develop user/maintenance guidelines during his meeting with the village preceding construction. For those villages which will only receive spring catchment systems, the training of the committee members in the management and maintenance of their capped spring will take place also during this meeting. The SNHR spring catchment brigade will train the caretaker during the construction of the village's spring catchment system.

For those communities that will receive a well/pump, the committee members and caretakers from 5 to 8 villages will be grouped together, and a 3 day training workshop will take place, carried out by the extension workers. The committee members will be trained in system management, correct operation and use of the water supply system; the collection and management of a maintenance fund, simple bookkeeping procedures; supervision of preventive maintenance; record keeping procedures for all repairs carried out and spare parts replaced; procedures to ensure the cleanliness around water point, cleaning out of drainage canals and any additional laundry or animal drinking facilities and health education related to water used practices, and hygenic storage in the home. The training workshop will take place at one of the committee's villages in which a pump is installed, which has appropriate provisions for lodging the participants.

A member of the pump installation brigade will participate in this training workshop for one day to train the caretaker in the necessary preventive maintenance tasks for the pump.

The training of the water committee members for the piped distribution system

will have similar content, however, this training workshop will be carried out in the main town or center of the piped distribution system once the installation of the system has occurred. In addition to the above-mentioned skills, the committee members will also need to learn how to check and read water meters if they are installed in private institutions and households. During their training, these committee members will also have to identify from which organization in either Lubumbashi or Musumba they will purchase their pipes and spare parts. A member of the piped distribution brigade will assist in the training of the caretakers. The project will procure the caretakers' tools and supplies and these will be sold to the village's water committee, paid from their maintenance fund. These tools and supplies will be sold to the caretaker during his training.

Concurrent to the training of the committee members will be the training of the various water supply system repairmen. The training of the pump repairmen and the piped distribution system repairmen will be the responsibility of the respective SNHR brigades, however, either the chief of the extension unit, or one of the extension workers will assist in this 6 day training. The repairmen will also receive on-the-job training by assisting in the installation of 5 pumps. During the project's first year, 10 to 15 pump repairmen will need to be trained (one repairman for every 5 pumps installed). During each successive year 20 to 22 repairmen will need to be trained.

The training of the piped distribution repairmen will be carried out by the SNHR brigade during each installation of the system. Three repairmen per system will be trained (a total of 21 repairmen all together).

It is unknown at this moment if it will be possible to include a health education component, whereby either SANRU II project or the Shaba Refugee Health Project will provide the health education training, water-related visual aids, and bicycle to the existing health personnel located at hospitals, health centers, dispensaries, and health posts in the project area. If this does occur, then following the installation of the water supplies, the health personnel will intervene at regular intervals in the project villages to carry out health education, either for the water committee and/or target groups in the community (e.g., primary school children, women, youth, men). The health personnel will orient committee and other user groups to concept of clean water for health using improved water supplies and carry out demonstrations of hygenic procedures for collecting and storing water. In addition, health education related to to environmental sanitation can be included.

It is proposed that these health education interventions be carried out over a recommended period of two to three years. At periodic intervals, e.g., six month intervals, the extension workers should carry out follow-up visits to all the villages after installation of the improved supplies to meet with the Committee members and identify if the villages are encountering any difficulties in carrying out their VLOM responsibilities, to check if the water supply is functioning correctly, if the drainage canals are cleared and the area around the water point clean, etc.

Depending upon the refresher training needs of the committee members or at least 8 to 12 months after installation of the supplies, the extension unit should carry out a 2 day refresher training course for committee members and

caretakers. Depending upon the refresher training needs of the water supply system repairmen, or 12 months after the initial training, a member of the SNHR brigade should carry out a 4 day refresher training workshop for the repairmen.

The proposed action plan for the community development extension work is the following:

Village Extension Work:

(The initial village community development extension work will be carried out in a series of five to six village meetings, with a week interval between each village meeting.)

Initial Extension Work:

Project Information Meeting at Zone

Hold an information meeting with local government and military officials, representatives of government services in water supply sector, and representatives of religious missions in the zone. This meeting will be carried out by the project manager, chief of extension unit, and extension workers in each of the 3 project zones.

Village Extension Meeting - #1

Meet with local village leadership, present project, explain village decision-making process. Determine if village is willing to participate in project. Arrange for next meeting with entire village.

Village Meeting - #2

Explain project. Determine if improvement of water supply a felt need. Determine demand/number of users.

Collect information (community analysis) necessary for extension worker to assist community in selecting most appropriate water supply system in light of their population, spatial distribution patterns, resources and capacities. Explain advantages and disadvantages of water supply system(s).

Explain project requirements for village in terms of cash, labor, materials, community organization structure, technical aspects and maintenance aspects.

Village Meeting - #3

Determine if village will participate and choice/acceptance of water supply system. Discuss criteria for water committee. What are tasks and responsibilities for committee and caretaker.

Village Meeting - #4

Village will present its water committee members, caretaker, and candidates for repairmen. Extension worker assists community in determining what materials, manpower, and tasks are necessary for preparation for and during construction. Arrange for food/lodging for SNHR brigade.

Village Meeting - #5

Extension worker verifies if village has fulfilled its commitments in terms of:

- collection of maintenance fund (this is not necessary if village has only spring catchment,
- preparation of roads and site,
- collection of local material,
- adequate provision for workcrews to assist SNHR brigade during construction.

If village has fulfilled its commitments, construction can commence.

Village Meeting - #6

If it is feasible for extension worker to return to village immediately following construction, extension worker will assist village and caretaker in developing user guidelines as to correct operation and use of system. Maintenance guidelines also developed. Informal training of committee members, in case of spring catchment system also takes place.

If it is not feasible for extension worker to carry out this 6th meeting after installation of water supplies, all of these activities should be carried out in meeting #5.

Follow up visit to the villages should be carried out at six-month intervals, following installation of the water supplies.

List of Suggested Educational Materials, Manuals and Visual Aids to be used during:

- Extension Workers Training Workshop
- Information Meeting at Zone Level
- Village Extension Meetings
- Training of Village Committee Members, including Caretakers

- Training of Repairmen
- Training of three Church-based Mechanics (Back-up Maintenance Service)

Extension Workers Training Workshop:

SANRU Health Education Flipchart "Hygiène de l'Eau"

- It is recommended that this flipchart be revised and adapted to depict images and dress of people and villages in Lualaba Region. In addition, pictures should be added to show:

  - a spring catchment system with fence around it and laundry facilities,

  - a well/borehole equipped with an Indian Mark II pump, apron, drainage canal, drywell and fence,

  - piped gravity distribution system with public standposts and taps, and drainage system.

- Manuals 1 and 2 of CEPAS on "Education Sanitaire/L'Hygiène de l'Eau"

Posters will need to be drawn:

- depicting Indian Mark II pump above ground and below ground parts

- showing all pump's spare parts

Project Information Meeting for Officials at Zone Level:

During the various stages of the construction and installation of the various water supply system, photographs in black and white can be taken. These photographs can be made into slides, and these slides can be shown at these Information Meetings to depict the project's water supply installations.

Village Extension Meetings:

During these meetings the revised flipchart would be useful.

- Small portable posters showing a model of the written engagement to be signed by the project/SNHR and the community with pictures depicting the village contributions:

  - Water Committee

  - Caretaker

  - Supplies and tools for caretaker's preventive maintenance

- Collection of local materials
- Manpower to assist in construction

Training of Village Committee Members:

A manual with a list of committee's tasks in management and maintenance of system and including:

- Bookkeeping procedures for treasurer for administration of maintenance fund, record keeping procedures for recording history of maintenance and repairs of water supply system and spare parts replaced.

Training of Caretakers:

A manual listing (or if caretaker is illiterate) depicting steps of preventive maintenance tasks:

- for spring catchment system and drainage system
- for handpumps, pump apron, and drainage system
- for public standposts/taps and drainage system

Training of Repairmen:

Pump Repairmen:

The exporter (TATA Exports) of the revised Indian Mark II pump is revising the pump manual. When this is available it should be translated into French, Swahili, and, if necessary, Lunda and/or Tshokwe to be distributed to the 100 pump repairmen.

In addition, the SNHR Pump Installation brigade and the 3-church-based mechanics will also use this manual when they are trained by technician/trainer supplied by TATA Exports.

Piped-Distribution Repairmen:

It is suggested that the chief of the extension unit, with the assistance of a member of the SNHR brigade, prepare a manual reviewing all the tasks and possible repairs.

The proposed strategy for carrying out the community development extension work is based on the following assumptions. These can serve as suggestions for the project's allocation criteria:

- Communities will be offered a choice of options of improved water supply systems whenever it is technically and economically feasible.

- The allocation criteria will be based on the village's population size, hydrological situation and ability to support the maintenance requirements and costs of the water supply system in question.

- The proposed norm is one water point per 250 inhabitants in order to provide each person with 30 liters of water per day.

- Based on the findings of the socio-economic survey, villages with less than 250 inhabitants may not be able to support the annual handpump maintenance costs.

- In the event a village has less than 250 inhabitants and it has a spring which can be improved with a spring catchment system, the only option proposed to the village will be a spring catchment system.

- A village with 200-500 inhabitants in which there is no spring, will be offered the option of a rehabilitation of well with handpump (if there is a well which meets technical criteria to be rehabilitated) and if this is not the case, the village will be proposed a borehole with handpump. The feasibility of installing these systems will depend on the extension worker's assessment as to whether the village can provide the long-term support for management and maintenance as well as have the financial capacity to pay the pumps O&M costs.

- A village of 250 inhabitants which is entitled to one water point in which a spring is found, will be offered the choice between a spring catchment system or a well/borehole with handpump.

- In villages of 250 inhabitants or more, e.g., 250 to 500, would be entitled to two water points. Depending on whether the village has a spring which could be capped, and a well which could be rehabilitated, the options would be a combination of two water points, e.g.:

    - a spring catchment and rehabilitated well with handpump, or

    - a spring catchment and borehole with pump, or

    - a rehabilitated well/handpump and a borehole/hole, or

    - two boreholes with pumps.

- The same allocation procedure as above would be applied for larger villages determining first, the number of users, the existing water points which can technically be improved and then the number of additional water points to be installed, depending on the total number of users.

- In order to reduce the number of spring catchment systems, wells or boreholes with pumps to be installed, those villages which can be served by an expanded piped distribution system will only be offered the option of a piped-distribution system (public standposts with taps in villages). It may be feasible, where it is technically possible to cap a spring, to also provide these villages with a spring catchment system as well.